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Expected operational synergies as a determinant of M&A premium levels and their cyclical changes in time

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Purpose of the study

Expected synergies are often presented as a motivator to pay high premiums in corporate mergers and acquisition. In the existing literature on the topic, however, there is a distinct dissonance on whether this holds true empirically. Apparently, the inability to agree on the role of expected synergies as a determinant of takeover premiums stems from differing interpretation of synergies as a concept and differing methodologies to measure synergistic value. This paper aims to provide new information to this discussion via three vehicles. First, I narrow the scope from overall synergies and focus merely on operational cost-side synergies to decompose the relationship between premiums and expected synergistic value. Secondly, I introduce differing valuation processes between industries as a possible way to increase prediction power for premiums. Thirdly, I study the premiums' autocorrelative time-behavior and its dependency on expected operational synergies as an extension to speculative explanations for the premiums' momentum proposed in extant research.

Data and methodology

The data set consists of 2,082 European public takeovers between 2006 and 2015, extracted from Mergermarket database. The relationship between takeover premiums and expected operational synergies is tested with simple OLS regressions and subsequent F-tests for testing the joint power of additional variables included in the model, with and without a set of industry classification binaries included. The momentum effect in premiums is confirmed with estimating monthly premium average's autocorrelation coefficients and testing their significance. Based on these results, an autoregressive moving average model is estimated for two subgroups determined by the assumed existence of expected operational synergies to determine whether changes in expected operational synergies cyclically drive the premiums in time.

Findings

Takeover premiums are found to be generally independent on expected operational synergies. Also, premium levels significantly differ between industries. The expected operational synergies' role as a determinant of takeover premiums is found to significantly deviate between industries, but individual industries where the effect would be considerably strong are not identified. Consistently with the existing research, takeover premiums are found to exhibit momentum. Specifically, monthly premium averages are found to be correlated with up to five lagged monthly periods. The time-behavior of premiums is not found to significantly deviate between transactions with and without expected operational synergies. Thus, it is concluded that changes in expected operational synergies do not generally drive takeover premiums.

Keywords mergers and acquisitions, premiums, synergies, momentum

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Tutkimuksen tarkoitus

Odotettujen synergioiden on usein esitetty motivoivan yrityksiä maksamaan korkeita preemioita yrityskaupoissa. Tutkimustulokset olemassa olevassa kirjallisuudessa aiheeseen liittyen ovat kuitenkin ristiriidassa keskenään. Tämän oletan johtuvan tutkimuksissa käytetyistä eriävistä näkökulmista synergioiden mittaamiseen. Täydennän edellämainittua keskustelua tarjoamalla uutta tietoa kolmea kanavaa pitkin. 1) kavennan näkökulmaa kaikkien synergioiden samanaikaisesta analysoinnista operatiivisien kulukarsinnan tuloksena syntyvien synergioiden tutkimiseen parantaakseni ymmärrystä premioiden syntyyn vaikuttavista yksityiskohtaisista tekijöistä. 2) tuon keskusteluun toimialojen väliset erot yristysten arvostuksessa yhtenä preemioita selittävänä tekijänä. 3) tutkin preemioiden aikasarjakäyttäytymistä ja sen käytöksen riippuvuutta odottetujen operatiivisten synergioden kanssa. Tämä analyysi toimii vastauksena viimeaikaisten tutkimusten esittämiin spekulatiivisiin arvioihin preemioiden aikariippuvuuden synnystä.

Lähdeaineisto ja tutkimusmenetelmä

Analyysi perustuu Mergermarket-tietokannan lähdeaineistoon, joka pitää sisällään 2082 Euroopassa tehtyä julkisesti listatun yrityksen ostoa vuosien 2006 ja 2015 välillä. Tutkin preemioiden ja odotettujen operatiivisten synergioiden keskinäistä suhdetta OLS regressioanalyysillä. Analyysi pitää sisällään useamman regressiomallin, joissa lisättyjen selittävien muuttujien yhteistä merkitsevyyttä tutkitaan F-testeillä binääristen toimialaindikaattoreiden kanssa sekä ilman niitä. Preemoiden aikasarjakäyttäytymisen analysoinnin pohjana arvioin preemioiden kuukausittaisten keskiarvojen autokorrelaatiokertoimet sekä testaan näiden kertoimien tilastollista merkitsevyyttä. Näiden tulosten pohjalta arvioin autoregressiivisen liikkuvan keskiarvon mallin kahdelle ryhmällä, joita erottaa odotettujen operatiivisten synergioiden oletettu olemassaolo. Tämän tarkoitus on paljastaa, ohjaavatko odotetut operatiiviset synergiat yrityskaupoissa maksettujen preemioiden suuruutta yli ajan.

Tulokset

Preemioiden havaitaan olevan riippumattomia odotettujen operatiivisten synergioiden suuruudesta. Preemiot ovat merkitsevästi erisuuruisia eri toimialoilla. Odotettujen operatiivisten synergioiden vaikutus preemioiden suuruuteen eroaa merkitsevästi eri toimialojen välillä, mutta yksittäisiä toimialoja, joilla vaikutus olisi merkitsevästi suurempi, ei havaita aineiston pohjalta. Preemioiden havaitaan olevan riippuvia viimeaikaisten preemioiden suuruudesta. Tämä tulos on yhdenmukainen viimeaikaisen tutkimusaineiston kanssa. Lisäksi havaitsen, että viimeaikaisten valuaatiotasojen vaikutus tämänhetkisiin preemioihin on merkitsevä viiden kuukauden ajalta. Preemioiden aikasarjakäyttäytymisessä ei havaita eroavaisuuksia yrityskaupoissa, joissa oletetaan olevan odotettuja operatiivisia synergioita.

Avainsanat yrityskaupat, preemio, synergia, momentum

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1 Introduction

To initiate a public takeover, the acquiring company makes a bid for the target company's assets (i.e. asset sale) or its equity base (i.e. stock sale). In successful acquisitions, the bid is usually valued at a premium relative to the target's estimated fair value on standalone premises. While some mergers and acquisitions are motivated by dubious reasons, such as agency motives and managerial hubris, the economic argument for undertaking an acquisition valued at a premium relates to potential synergies associated with the transaction (see e.g. Berkovitch and Narayanan, 1993; and Damodaran 2005).

If merging two companies together creates synergistic value, the incremental value-add is possible to split between the acquirer and target company shareholders so that all involved parties gain. For the acquiring company shareholders, the gain is incorporated in long-term share price development, whereas for the target company shareholders, the gain materializes in the form of acquisition premium paid by the acquirer as the deal closes.

With regards to the size of the premium, conventional wisdom mostly speaks to correlative relation between the premiums and the amount of synergies that the acquiring company's management expects to achieve by merging the two companies together. This precept is not without academic support. Bradley et al. (1988) find that acquisitions, on average, increase the total value of the acquiring company and the target by 7.4%. Also, Gupta and Gerchak (2002) propose that the bid price premium relative to the target's prevailing pre-announcement stock price can be justified by operational synergies. Interestingly, Gupta and Gerchak also base the analysis on an assumption that the acquirer makes long-term use of the target company's entire capacity. In other words, they only account for revenue side synergies, while the value created by cost reduction is excluded from the analysis altogether. They do this despite that cost synergies in particular are conventionally considered as the most value-creative of the two. The implication is that Gupta's and Gerchak's (2002) valuation serves as a mere lower bound to the actual value created through the acquisition.

Revenue synergies have been a subject to considerable critique. This tends to be true especially outside the academic research domain. The controversiality with regards to revenue synergies emerges from the difficulty to measure and capture them. While admittedly in some cases revenue synergies can be truly value-creative, they are likely to be overestimated by the management or do not realize at all (see e.g. Ficery et al., 2007). Christofferson et al. (2004) also find consistent results in a McKinsey study, presenting that in less than 17% of acquisitions

promised revenue side synergies are ultimately delivered fully, while cost side synergy targets are met in 35% of all acquisitions, i.e. in more than double of all transactions as opposed to revenue synergies.

While cost synergies have been less criticized and are arguably easier to both capture and measure, they too are challenged by some researchers. E.g., Slusky and Caves (1991) find no evidence of connection between real synergies and acquisition bid prices whatsoever, either on cost or revenue side, but conclude that other factors than operational synergies drive the price paid in acquisitions. These factors vary from financial synergies and arbitrage between real and financial assets to managerial behavior, and competitive environment[1].

Conclusively, it remains debatable if acquisition synergies in most corporate mergers even exist. Nonetheless, many acquiring companies announce certain synergy targets or estimates together with deal announcements. Given that fewer synergies tend to materialize than what the management projects (see e.g. Ficery et al., 2007), the announced level of synergies, on average, is overestimated.

At least two identifiable reasons exist for the overrating of announced synergies. Firstly, the management might exhibit overconfident behavior and overestimate their ability to create synergies between the two companies. This explanation is consistent with the fact that many researchers have found significant evidence of managerial overconfidence in corporate investments (see e.g. Malmendier and Tate, 2005) as well as in acquisitions behavior specifically (see e.g. Malmendier and Tate, 2008). Hence, it is probable that at least some level of systematic miscalibration biases the managers' estimates of synergies upwards. As a result, the announced synergies are overstated relative to the extent that they are most likely going to realize. This reasoning, nevertheless, implicitly subsumes an assumption that the managers intend to give unbiased estimates of the realizable synergies to the public, and therefore the communicated level of synergies converges with the managers' sincere assessment.

The second possible reason is that regardless of the accuracy of the management estimates, the managers might intentionally communicate an overestimated level of synergies to the public. This behavior would better enable the management to "sell" the deal to the public, principally

[1] With 'financial synergies', Slusky and Caves (1991) refer to exploiting the discrepancy between the acquirer's and the target company's financial stringency; If there is a difference between the two companies' internal funds' opportunity cost, and considerable transaction costs are associated with external financing, an acquisition could be value-creative to the extent of the decrease in external financing costs net of transaction costs associated with the acquisition itself.

to the shareholders of the acquiring company, to get the transaction carried out regardless of whether the acquisition in fact is expected to create shareholder value. If the management can stir up a public sense of high synergies associated with the merger, a higher acquisition premium is mentally justified and accepted by the shareholders, and the deal is more likely going to close successfully. Alike managerial behavior might be induced by private benefits arising from excessive M&A activity, or empire building (see e.g. Trautwein, 1990; Holl and Kyriazis, 1997). It is noteworthy that the abovementioned vehicles via which the announced synergies are overestimated can be alternative or, perhaps more likely, affecting jointly.

1.1 Research problem and purpose

Whether the publicly announced synergy targets are unintentionally overestimated or intentionally overstated, one would intuitively expect that higher premiums generally follow high expected synergies. In the extant research, however, there is a distinct dissonance on whether this holds true empirically.

Advocates of the causal relation between takeover premiums and synergies include e.g. Lambrecht (2004) who proposes that cumulative post-announcement returns for the acquirer and the target company are determined by three factors, namely synergies, size and hysteresis. Also, Gupta and Gerchak (2002) find a significant coefficient for operational synergies when tested on the premiums. While empirical evidence suggests that acquirers, on average, produce zero or negative abnormal returns at the deal announcement (see e.g. Fuller et al., 2002), Bradley et al. (1988) find that acquisitions, on average, have an increasing effect to the combined value of acquirer and the target company equity. They also find that the increase in the combined equity value is independent on the allocation of value between the buyer and the seller. This result implies that the size of the premium paid to the target company shareholders in an acquisition negatively contributes to the announcement return for the bidding company's share price.

Perhaps the most influential piece of research on the opposing side of studies on the synergy effect is that of Slusky's and Caves' (1991), who conclude that synergistic variables are unable to explain acquisition premiums. Following in their footsteps, many researchers in subsequent studies have even considered the size of the premium as an approximation for the degree of adverse quality in the managerial decision making (Laamanen, 2007). Consistently with Slusky and Caves (1991), Gondhalekar et al. (2004) present evidence that synergies do not significantly

affect takeover premiums. Instead, they find that the bid pricing is rather driven by managerial agency.

Given the differing views in the existing research on whether the level of takeover premiums follow the existence of expected synergies, a more detailed review on the topic is called for. For this reason, in this paper, I intend to provide new information about the relationship between takeover premiums and expected synergies by decomposing the possible interdependency with statistical tools which are, to a large extent, novel to this research area.

The analysis is three-fold. First, the connection between takeover premiums and synergies is analyzed in a simple empirical setting to determine whether expected synergies drive premiums paid in corporate mergers and acquisitions. Secondly, I proceed to study whether differences between industries can provide new information about the aforementioned relationship, which is largely an undocumented area in this field of research to date. Lastly, I validate the previous results by comparing average premiums in different points in time separately for acquisitions with and without assumed synergies. The analysis of the relationship between premiums and synergies from this complementary standpoint is intended to provide new evidence on whether changing levels of synergies drive the premiums in time.

Measures used to approximate synergistic value vary in prior research. Early studies mostly develop simple measures of relatedness between the acquirer and the target company businesses. For instance, Rumelt (1974) calculates the relatedness of two companies by observing the policies used to integrate its assorted businesses. Similar measures were also used in a more statistics-oriented study by Lemelin (1982). Caves (1975) uses the standard industry classification (SIC). In a subsequent study, Slusky and Caves (1991) develop Caves' earlier measure to account for the portion of acquirer's and the target's sales that are deemed to have potential for synergistic gains. Some of the more recent pieces of research have pursued more complex approaches to capture the synergies' effect on takeover premiums. For example, Lambrecht (2004) derives a computational variable for the incremental output of the merged entity relative to the two standalone companies' combined output prior to the merger. Gupta and Gerchak (2002), on the other hand, present a relatively complicated real option model for synergies.

While different measures for synergistic value have been proposed, constructing an all-encompassing approximation for synergy has proven to be a difficult task due to the synergies' intrinsically abstract nature. Perhaps a more fruitful approach to the issue would be to focus in

one type of synergistic value at a time, which enables the researcher to develop an appropriate measure for the particular concept under primary interest. With regards to the extant research on the topic, synergy measures that are drawn from the relatedness of the acquirer and target company industries (see e.g. Rumelt, 1974; Caves, 1975; Slusky and Caves, 1991) better capture the cost-reduction potential for the combined entity, whereas computational variables for incremental output (see e.g. Lambrecht, 2004) tend to focus in revenue side synergies. Taking into account that revenue synergies are conventionally considered as less value-adding relative to cost-reduction potential (see e.g. Ficery et al., 2007), I choose to adopt the former methodological approach.

Consequently, the results of this study are primarily applicable to the extent that expected synergies are interpreted as potential for cost-reduction and other ways of operational streamlining expected to result in incremental combined equity value between the two companies, i.e. operational synergies.

1.2 Contribution to existing literature

Although the extant research is not altogether unfamiliar with the connection between takeover premiums and synergy, the results have been somewhat inconsistent with each other. As has been covered in '1.1 Research problem and purpose' section of this paper, it is possible that the inconsistency stems partly from ambiguous definitions for synergy and differing measures employed to approximate synergistic value expected to be created in a transaction. Therefore, this study aims to provide new information about the topic by decomposing the concept of synergy and focusing in only source of synergistic value-add, operational synergies. This approach has been chosen particularly for the fact that operational cost-side synergies are found to be more value-adding as opposed to other forms of synergistic value (see e.g. Ficery, 2007), together with the notion that cost-side synergies are more likely to arise when the buyer and the seller companies are convergent in terms of their business models (see e.g. Slusky and Caves, 1991).

While the early literature on the topic mainly adopted a likewise methodological approach (see e.g. Rumelt, 1974; Caves, 1975; Slusky and Caves, 1991), there are no in-date studies available in which the relation would be analyzed comprehensively before this paper, to the extent of my knowledge. Moreover, the existing studies are often limited in their sample sizes and geographically focus in one country at a time, particularly the United States, whereas an

analysis of the European takeover market enables to cover any possible differences between domestic and cross-border transactions.

In addition, the extent to which the merging companies can materialize synergies is dependent on the industry they are operating in. Nevertheless, the existing literature mostly disregards any possible interindustry differences in the relationship between premiums and synergies. Therefore, in this study, I cut into the industry differences to provide novel information about the determinants of the takeover premiums.

Most studies on the topic of premiums and synergies base their conclusions on simple regression analyses without considering any possible variations in the effect in time. Interestingly, another line of financial research has documented a time-dependency in the premiums alone (see e.g. Simonyan, 2014). Furthermore, it has been proposed that this time-behavior is possibly driven by changing levels expected synergy common to all transactions (see Rosen, 2006). However, the connection between changing levels of premiums and synergies in time has not been empirically studied to date. For this reason, in this study, I position the latter part of this study in the intersection of the two lines of research and present new evidence on whether changing levels of synergy cyclically drive premiums in corporate takeovers.

1.3 Main findings

This study presents evidence that takeover premiums paid in corporate takeovers are generally independent on expected operational synergies. This result is consistent with those of Slusky and Caves (1991) and Gondhalekar et al. (2004). The level of takeover premiums is also found to display differences between industries. Moreover, the effect that expected operational synergies have on the premiums is found to differ between industries. However, individual industries where the effect would be particularly evident were not identified.

Consistently with Simonyan (2014), takeover premiums are found to exhibit momentum. Significant dependency on recent history was observed up to five previous monthly periods. While Rosen (2006) proposes a possible explanation for the momentum in premiums that changing levels of expected synergy common to all acquisitions drive the general level of premiums in time, this study finds inconsistent results. Specifically, expected operational synergies are found to be unable to explain the dependency of periodic premium averages on recent historical periods. In light of these results, I propose that the cyclicality of takeover

premiums is driven by benchmarking in valuation processes which gives rise to temporal market conventions for a comparably attractive valuation level. Moreover, I expect that the changes in this convention is, to a large extent, random rather than possible to convincingly explain on rational basis.

1.4 Practical implications

The observed independency between takeover premiums and expected operational synergies challenges the conventional perception of how the target companies should be valued in corporate takeovers. The central question under interest is whether generous premiums are paid because the deals are likely to create synergistic value, or to ensure that transactions are successfully carried out, often driven by dubious motives. While the descriptive resolution for this question is interesting per se, it also lays the groundwork for a normative question of how much a potential acquirer should be willing to pay for a target company.

While generous premiums are often justified by high expected synergies, the results of this study suggest that nonrational reasons come in to play when acquisitions are valued at high premiums. Therefore, investors should be on the alert for alike management pursuits to grow the company inorganically.

In the academic research domain, some studies even regard premiums and expected synergies as explicit proxies to each other (see e.g. Madura and Ngo, 2008). Considering the results of this study, such presumption is not recommended. On the opposite side of the researcher spectrum, some studies use the premiums as a measure for the degree of adverse quality in the managerial decision making (Laamanen, 2007). While this approach is arguably preferred relative to the former, it is noteworthy that the results of this study alone do not provide evidence against all possible sources of synergistic gains in corporate acquisitions but focus in the operational domain of synergies, leaving e.g. financial arbitrage as a possible motivator to pay inflated premiums.

1.5 Limitations of the study

As has been pointed out, the amount of synergy expected to be created in a corporate merger is difficult to estimate for the synergies' arbitrary nature. Therefore, the chosen methodology to measure synergies largely determines what type of synergies are tested and what portion of the

potential value-add is respectively disregarded, often unintentionally. In this study, I follow the example of e.g. Rumelt (1974), Caves (1975), and Slusky and Caves (1991) and derive the synergy measure from the similarity of the acquirer and target company industries, which in these studies has been recognized to correlate especially with cost-reduction potential in a given transaction.

It is noteworthy that while this measure is not particularly accurate in estimating expected operational synergies for individual transactions, even a weak connection between cost-reduction potential and the relatedness of the company industries constitutes solid large-sample properties that enable interpretation of the results of statistical analysis on aggregate level. Yet, other forms of expected synergistic value might come in to play in the valuation considerations when acquisitions are initiated. Therefore, the results of this study should be interpreted with a caveat when the bid price mostly bases on forms of expected value-add that do not characterize as cost-reduction potential or other ways of operational streamlining. A prime example of such expectation of incremental combined equity value between the two companies without expected operational synergies would be financial arbitrage and tax benefits that are undisputed and well documentable prior to the deal execution.

1.6 Suggestions for further research

A high number of significant determinants of acquisitions premiums has been presented in the financial literature to date. However, trends that drive the premiums in time are a much less-studied topic. Given the cyclicality of both acquisition volumes and valuation levels, a recommended step for subsequent research would be to identify further causes for the time-dependent behavior of premiums. Also, considering that the acquisition volumes and the premium levels are found to be inversely interrelated (see e.g. Simonyan, 2014; and Vanne, 2015), studying the connection between the two would be an interesting extension to the field of research.

1.7 Structure

After the introductory part of section 1, this report is structured as follows. Section 2 summarizes the existing literature on acquisition premiums and synergies. Tested hypotheses are developed in section 3. Data and variables, and methodology of this thesis are introduced

in sections 4 and 5, respectively. Results are presented in section 6, and their robustness tested in section 7. Lastly, section 8 summarizes and concludes the key takeaways of this paper.

2 Theoretical background and literature review

2.1 Takeover premiums

In this section, I summarize factors that are found in existing research to have an effect to the level of takeover premiums. This examination is divided to three subcategories, namely target company characteristics, acquiring company characteristics, and market-related factors. While some of the presented evidence and research results fall clearly under merely one of the abovementioned rubrics, it is noteworthy that many studies combine features of two or all three of the covered categories.

2.1.1 Target characteristics

Intuitively, one would expect that factors which make a potential acquisition prospect attractive to a potential buyer have a positive effect to the offered bid price, and thus the premium. This result was empirically confirmed by early pieces of research on the topic already some thirty years ago (see e.g. Haw, 1987; Hay, 1989). A general tendency in more recent literature has been to further decompose the attractiveness of a potential takeover target. It is noteworthy that an attractive takeover target does not necessarily translate into 'a good company'. This is because the attributes that generally make a good company, such as strong profitability and growth, positive prospects for future business development, nonvolatile cash flows etc., are typically already incorporated in the market value, that is, given that these attributes are known to the public. Therefore, motivation for the acquirer to pay a premium in addition to the pre-acquisition price must stem from other sources of value.

Two among the most frequently presented potential root causes for the willingness to pay a premium are information asymmetry and expected synergies between the acquiring company management and the public. Cai and Sevilir (2012) find that board connections between the acquirer and the target company increase the value creation and generally have a negative effect on the paid premium. The implication is that information asymmetries tend to drive managers into poor acquisition decisions, or at least to pay too generously for the takeover targets. In

addition, diminishing the asymmetry by establishing board connections also helps to estimate synergy potential between the companies. While the expected synergies are often considered as one among the most cardinal factors with regards to the size of takeover premiums (and are the central focus of this paper as well), I leave a more detailed inspection of existing research on synergies as a determinant of takeover premiums to subsequent sections in this paper.

Other than synergies and information asymmetry, one of the most evident factors that has repeatedly been shown to affect the size of takeover premiums in the existing literature is the target company size. Alexandridis et al. (2013) document a robust negative relation between the target company size and the premium relative to the target's pre-announcement market capitalization. Lambrecht (2004) uses a different measure for the target company size, and calculates a ratio of bidder size to target size. Likewise, this variable is found to have a significant negative effect on the takeover premiums, consistently with the abovementioned results. Due to the relatively high level of consent on the size effect in the extant research, target company size has been used as a control variable by exceptionally large portion of academic studies exploring the topic (De La Bruslerie, 2011).

Ownership structure of the target company has several implications to its attractiveness from a potential acquirer's perspective and to the price the acquirer needs to bid to succeed in the takeover attempt. Stulz (1988) presents evidence that the bargaining power of a large shareholder negatively relates to the size of the premium. Also, if large shareholders have established a shareholder agreement or other controlling devices, e.g. non-pro-rata voting rights or rights to cash distributions, the acquirer is forced to bid more aggressively, resulting in higher valuations, and thus higher premiums (Volpin, 2002; Belot, 2010).

Similarly, private benefits enjoyed by one or more significant blockholders positively contribute to the size of takeover premiums. As private benefits make the company more valuable for the large shareholders but not to the public, i.e. the stock price generally does not reflect the private value, the acquirer must bid higher premiums to convince the incumbent owners to accept the acquisition offer. This view is theoretically supported by Bebchuk (1994), Burkard et al. (2000), and Burkart and Panunzi (2004). Moeller (2005) presents empirical evidence with consistent results.

Financial leverage of the target company can also have an effect to the takeover premiums through the amount of private benefits (De La Bruslerie, 2011). The author argues that the effect is particularly pronounced for controlled companies of family-owned enterprises. If leverage

limits the amount of private benefits, premiums tend to be lower in case of highly levered companies. Alternatively, it is possible that high leverage enables the controlling shareholder to exert power in the company, thus amplifying their private benefits. Consequently, in order for the takeover to be successful the buyer must bid more generously, resulting in higher premiums (Stulz, 1988). Conclusively, it is undefined whether leverage overall has a significant effect to the takeover premiums, and if so, whether the effect is positive or negative.

Changes in the level of regulation within a certain industry tend to trigger economic shocks that contribute in clustering of mergers and acquisitions activity within that industry (see e.g. Mitchell and Mulherin, 1996; and Mulherin and Boone, 2000). Besides affecting the frequency of acquisitions carried out, the event can also have an impact to the size of an average premium paid in those transactions. Simonyan (2014) presents evidence that takeover premiums in industries that are under a relatively heavy regulatory burden are significantly lower in comparison to the average premiums within all industries. The author also documents that the premium discount tends to disappear concurrently with a deregulation event. Therefore, the average premium in the industry in post-deregulation state does not significantly differ from the market as a whole.

While most of the abovementioned factors affect the subjective value of a potential acquisition target to the bidder, the premium is also affected by speculative movements in the target's share price prior to the bid announcement. Because virtually all successful public takeovers are valued at a premium relative to the market's consent on the target's standalone value, i.e. the stock price, an anticipation that a given firm will eventually be acquired generally increases the firm's market value. The higher is the perceived probability of being acquired and the shorter is the time period the acquisition is believed to happen, the stronger is the anticipation effect to the share price. Consistently with this reasoning, Crawford and Lechner (1996) present empirical evidence that an anticipation of a takeover has a positive effect to the company's market value and thus negatively contributes to the size of the premium in the event that the acquisition materializes.

Schwert (1996) studies the relation between public takeover premiums and the target company's pre-announcement stock price movements. Specifically, the author identifies acquired companies that registered a notable runup in the share price prior to the acquisition announcement. The results show that the paid premium in relative terms and the pre-announcement increase in the target's stock price are generally uncorrelated. The implication

is that the bid price, on average, increases with a roughly linear slope relative to the pre-announcement share price. Therefore, any positive movements in the stock's market value prior to the announcement is an added cost to the bidder should the transaction eventually materialize.

2.1.2 Buyer characteristics

The buyer's choice for the means of payment used in the transaction is a pivotal factor in many respects in the transaction process, and has been found to significantly affect the size of the average takeover premium. E.g. Cheng et al. (2008) find evidence that the form of consideration and the takeover premiums are significantly interdependent. Academics have mostly explained the observed relation with information asymmetry (see e.g. Eckbo et al, 1990). A risk-averse buyer with nonperfect information is factoring an information risk discount to the bid price, and hence is willing to pay a smaller premium. For the acquiring company, one way to alleviate the risk arising from the information asymmetry is to transfer part of the risk to the target company shareholders by offering shares of the newly merged company (instead of cash) as the medium of exchange.

From the selling company shareholders' point of view, accepting equity or other securities is justifiable if the bid price then is higher compared to a cash offer on the abovementioned premises. This view, however, is not supported by empirics. On the contrary, cash deals are found to result in significantly higher premiums, on average (see e.g. Cheng et al., 2008; Ayers, et al., 2003; Amihud et al., 1990; and Travlos, 1987). However, it is noteworthy that the information risk mitigating motives might carry less weight in the target company shareholders' decision making relative to the upside of getting to share the value-add arising from expected synergies.

Hansen (1987) was the first to introduce the concept of "double lemons effect", which refers to the author's observation that mergers often actualize in a state of bidirectional information asymmetry between the acquirer and the target company. Given that equity is used as the means of payment, not only does the acquirer not know the true value of the assets it is buying but also the seller does not know the true value of the shares it receives in the barter transaction. Contrary to the abovementioned risk mitigating benefit of exchanging securities instead of cash advocated by both the seller and the buyer, the selling company shareholders' uncertainty with regards to the value of those securities discourages them to accept a use of noncash consideration, i.e. most often equity.

While the size of takeover premiums can be affected by mitigating the consequences of asymmetric information, an alternative medium to alleviate the issue would be mitigating the level of asymmetry itself. Chang and Mais (2000) present an idea that the state of considerable asymmetric information is less likely to arise when the buyer holds a large block of the target company's shares already prior to the merger announcement. The degree of prior ownership, or what the authors call a "toehold", is found to significantly reduce the asymmetry between the transaction parties. Further, the decrease in asymmetric information produces a significant discount in the takeover premiums. Transitively, an existence of a toehold results in a graduated decrease in the premium, on average.

Lang et al (1989, 1991) study acquisition activity with respect to firms' internally generated funds. The authors present evidence that companies characterized by strong internal free cash flows and relatively high book-to-market ratios are more aggressive in their acquisition behavior. These companies are often poorly managed and tend to pay higher premiums, on average. This phenomenon relates to loose shareholder scrutiny with regards to the internal funds relative to externally raised capital, enabling the management to exercise value-destroying acquisitions instead of entering in NPV positive investments or distributing excess cash to the shareholders.

Gondhalekar et al. (2004) find consistent results and add a note that the effect also holds conversely. Accordingly, companies that have a low level of internal financing available but are valued at low book-to-market ratios reflect under-investment behavior. As the cash flows are not sufficient enough to sponsor all positive NPV projects they undertake corporate acquisitions less frequently and tend to pay lower takeover premiums.

In addition to relative investment activity, a given company's acquisition behavior can be affected by dubious reasons that are not motivated by maximization of shareholder value. Berkovitch and Narayanan (1993) identify three key factors that generally motivate acquisitions, namely synergy, agency and hubris. Managerial hubris, along with CEO overconfidence is a much-studied topic in the academic domain and found to result in value-destroying activities, including poor mergers and acquisitions valued at excessively high premiums (see e.g. Malmendier and Tate, 2005; Malmendier and Tate, 2008; Brown and Sarma, 2007; and Doukas and Petmezas, 2007). Interestingly, Hayward and Hambrick (1997) find that the effect of managerial hubris or exaggerated self-confidence in managerial decision making

is at its strongest when the board of directors include a high proportion of inside directors and when the CEO also acts as the chairman of the board.

Other psychological factors that guide the managers' conduct on mergers and acquisition activity include anchoring the bid price to the target's earlier share price performance. The anchoring effect was introduced for the first time by psychologists Tversky and Kahneman (1974), and later applied to corporate finance by, among others, Baker et al. (2009) who find significant evidence that the likelihood of an acquisition being successful sees a graduated increase when the bid price exceeds the 52-week high of the target's stock price.

Not all extant literature, however, agree that hubris and behavioral biases play key roles in companies' acquisition activity. Gondhalekar et al. (2004) revisit Berkovitch's and Narayanan's (1993) results on acquisition motives and present that the most prominent of the three motives is agency, whereas synergistic value and hubris effect are not found to be robust. The latter result implies that the non-value-adding measures that companies undertake are not caused by managerial misjudgment but rather by the managers' tendency to prioritize their own utility, i.e. expected compensation and perquisites, job security, career prospects, power, personal reputation etc., over that of the company's shareholders.

2.1.3 Market factors

The size of an average takeover premium also depends on the state of economy. It has been argued that changes in the phase of a business cycle arouse temporary market misvaluations. Simonyan (2014) finds that the average premium size, in relative terms, is higher during recessionary periods and lower during periods of considerable investor optimism. The implication is that the bid prices tend to factor in a correcting component towards the "true" long-term value of the asset depending on the current market sentiment at any given state of economy.

Extant literature on mergers and acquisitions during different economic periods mostly focuses on the volume of transactions rather than the size of the premiums. Clearly, mergers and acquisitions activity tends to peak during economic booms and slow down during recessionary periods (see e.g. Goble and White, 1993; Shleifer and Vishny, 2003; Harford, 2005; and Rhodes-Kropf et al., 2005). Volume of merger activity and the size of average premiums also seem to be inversely interconnected. Simonyan (2014) shows that prior stock market returns are negatively correlated with the size of takeover premiums. Consistently, Vanne (2015)

presents that during recessionary periods, only mergers with high expected synergies are executed, whereas during times of strong investor optimism the threshold for expected synergies is relatively lower. Consequently, given that takeover premiums approximate expected synergies, the volume of transactions is lower and the average premium paid in an acquisition is hence higher during recessions. This theory is also supported by empirical evidence.

Furthermore, Simonyan (2014) finds evidence that high takeover premiums are more likely to occur during times of high stock market volatility. Given that takeover premiums tend to be higher in the bottom of an economic cycle, the relation between premiums and volatility can be explained by the positively correlative relation between stock market volatility and raising investor pessimism, which has been documented in a theoretical setting by De Long et al. (1990) and empirically by Lee et al. (2002).

Rosen (2006) finds that an acquirer's share price is more likely to increase at the deal announcement if there have been many well-received acquisitions in the industry lately. This gives rise to so-called "hot" merger markets. Simonyan (2014) extends the analysis to the bid prices in public takeovers. In the study, takeover premiums too are found to exhibit positive autocorrelation and can, to some extent, be explained by similar momentum effect as merger and acquisition volumes. In other words, if multiple comparable acquisitions before a given transaction have been valued at a substantial premium, the transaction itself is likely to be priced generously.

The best-case scenario for shareholders of a potential acquisition target is that the public tender offer triggers other bids from competing bidders. Naturally, if the bidders engage in an open bid war, the winning offer price is likely to be higher relative to the valuation in a non-contested acquisition. Stulz et al. (1990) study the contestability in an empirical setting and show that the existence of one or more competing bids increases the size of the premium. Also, Song and Walking (1993) find consistent results.

2.2 Synergies

Bradley et al. (1988) present evidence that merging two companies together increases their combined value, on average. It has been argued that this value-add reflects the amount of expected synergies involved in the transaction. Generally, the concept of synergy refers to a creation of a combined entity that is greater than the simple sum of its parts. In the domain of

corporate takeovers, however, the use of the term ‘synergy’ tends to vary slightly from one author to another.

One way to approach the categorization of sources of synergistic value is to divide synergies to operating arbitrage and financial arbitrage. On the operating side, a merger can add value via economies of scale, which refer to the cost savings emerging from increased volume of production. Another source of value would be economies of scope. Unlike economies of scale, the scope economies do not arise from incremental volume but from improvements in efficiency, for example, by producing multiple distinct goods parallel. Furthermore, some textbooks identify transaction cost economics as a third source of value. The concept of transaction cost economies has sometimes been used as a central argument for a more philosophical question of why individual companies even exist if additional costs occur whenever a product or a service crosses company boundaries. From the mergers and acquisitions point of view, transaction cost economics can be viewed as a value-adding component emerging from reduced need for negotiating contracts and other frictions involved in intercompany trade. Together, these effects are found to motivate acquirers to bid more generously (Sundarsanam et al. 1996, Officer 2003).

Yet another source of value in merging two companies together is a potential increase in the market power towards other stakeholders. Merging two companies together increases the sheer size of the combined entity, and drives the markets to a more oligopolistic or, in extreme cases, monopolistic direction. This is generally beneficial for the company via improved bargaining power with both suppliers and buyers, the latter including either retailers or end-users (or both), depending on the company’s business model.

Concurrently with operating synergies, the company might be motivated to pursue a merger due to potential value-add via financial arbitrage. Examples of financial gains in a merger include decreased cost of external financing, such as bank debt due to lower uncertainty in the company’s cashflows, and equity due to improved liquidity of company shares in the secondary market. What are usually more important, nonetheless, are tax advantages that can have a substantial and predictable effect in the company’s finances.

The existing research does not fully agree on the significance of operating and financial synergies. E.g. Gupta and Gerchak (2002) find evidence that operational synergies significantly affect takeover premiums. This result is also advocated by Lambrecht (2004). Inconsistently

with the above two, Slusky and Caves (1991) propose that the premiums are affected by financial although not by operational synergies.

3 Hypotheses development

In the preceding sections of this paper, I have identified a dichotomy of two schools of thought on whether synergies convincingly explain premiums paid in corporate takeovers. As has been covered, the proponents of the idea include e.g. Gupta and Gerchak (2002), and Lambrect (2004), whereas the opposing side is advocated by Slusky and Caves (1991), and Gondhalekar et al. (2004). While the conclusions of these studies are somewhat inconsistent with each other, it is unclear to what extent the inconsistency stems from (a) differences in sample sizes, geographies and time periods used in the data collection, and (b) what portion is respectively attributable to differing methods employed to measure synergistic value.

Given the pronounced alteration in the methodological approaches between the different studies, the latter explanation is probable. The existing studies to date do not fully agree on how the concept of synergy should be defined and how it should be measured. In order to draw empirical conclusions, however, it is important to specify what exactly is referred to when synergies are discussed. In this study, it is not my ambition to author an all-inclusive analysis of all forms of potential synergistic value but to focus on the part that is conventionally considered as the most value-adding, i.e. operational synergies, especially relating to cost-reduction (see e.g. Ficery et al., 2007).

Consistently with earlier pieces of research that focus in measuring the cost-reduction potential by e.g. Rumelt (1974), Caves (1975), and Slusky and Caves (1991), I derive a measure for expected operational synergies from the similarity of the acquirer and the target company businesses. The main reasons for employing this methodological approach can be summarized as follows.

(a) Similarity of the two businesses is known prior to the merger implementation, and therefore is more applicable to be compared with acquisition premiums, relative to e.g. materialized synergies known only in a post-merger state. (b) The existing research (see e.g. Rumelt 1974; Caves, 1975; and Slusky and Caves, 1991) has recognized that the similarity of the businesses strongly associates with cost-reduction potential which is found to be the most value-adding

source of synergistic value (see e.g. Ficery, 2007). (c) The similarity measure is minimal in its complexity, allowing for analyzing the synergy effect without incorporating additional assumptions in the formulation of the theoretical model under estimation. (d) The similarity measure is unequivocally convertible into a binary indicator, which enables for testing parameter differences between two groups determined by that binary variable.

The expectation of operational synergies is often presented as a justification for paying substantial premiums (see e.g. Berkovitch and Narayanan, 1993; and Damodaran 2005). On the other hand, managers of an acquiring company might be tempted to execute transactions for purely private reasons such as managerial agency or hubris (see e.g. Berkovitch and Narayanan, 1993). In this case, nonetheless, a rational justification for the transaction needs to be communicated to the public to convince the owners that the deal makes economic sense. Consequently, it is possible that expected operational synergies are used as reasoning for acquisitions even though the rationale for the synergy expectation would be tenuous, or at least overestimated in its importance. Therefore, it is unclear whether generous premiums are paid because the deals are likely to create synergistic value, or to ensure that transactions are successfully carried out, often driven by dubious motives.

Given the abovementioned discussion, I hypothesize that takeover premiums and expected operational synergies are independent on each other. The first formal hypothesis reads as follows:

H1: The level of takeover premiums is independent on expected operational synergies.

Regardless of the magnitude of the interdependency between expected operational synergies and takeover premiums, other factors than expected synergies certainly affect acquisition premiums. As has been covered in the ‘2.1 Theoretical background and literature review: Takeover premiums’ section of this paper, a number of significant determinants have been identified in the existing literature. These factors include target company characteristics (such as target company size, ownership structure, financial leverage, etc.), buyer-related factors (such as preferred method of payment, information asymmetry, book-to-market ratio of the acquirer, etc.), and market-related factors (such as business cycle development, together with stock price movements prior to the deal announcement, contestability of the bid, etc.). While

e.g. Simonyan (2014) pays attention to the target company industry by dividing companies to those that operate in heavily regulated industries and companies in sectors with less central policy regulation, most studies disregard the potential variability in the relation between synergies and premiums between different industries altogether.

Moreover, synergies have in some studies been approximated with measures that are arguably unequally applicable to different industries. Intuitively, however, one would expect that the level of expected operational synergies would systematically be higher within some industries and lower within others. Despite this, to the extent of my knowledge, it has not yet been explicitly studied whether these differences translate into higher takeover premiums. Therefore, testing for the possible interindustry differences provides valuable information to help explaining how the takeover premiums are determined, as opposed to being driven solely by expected synergies. Accordingly, I hypothesize that the level of takeover premiums is independent on the industry class.

It is also possible that companies in different industries follow different processes in evaluating potential takeover targets. For example, while cost-savings from merging two companies together could be reasonably accurately modelled between two, say, transportation companies, the synergy potential would be much more difficult to estimate between two high-technology enterprises. As a result, expected operational synergies would play a different role as a determinant in the bid price between different types of industries. This potential difference is studied in this paper by analyzing the interaction effects between the expected operational synergies and the industry classes. That is, whether the expected operational synergies have an effect to the bid price given a condition that the target company represents a certain industry sector in addition to the synergy effect that is common to all industries.

Accordingly, I hypothesize that the relationship between the expected operational synergies, measured by the similarity between acquirer and target company businesses, and the takeover premiums is independent on the industry class of the target company. The formal specification of the second hypothesis, expressed in two parts, is stated as follows:

H2.1: Takeover premiums are industry-independent.

H2.2: The relationship between takeover premiums and expected operational synergies is independent on the target company industry.

Simonyan (2014) finds empirical evidence that takeover premiums exhibit momentum. Put differently, the premiums are positively correlated with the premiums paid in recent transactions. A theoretical framework for this phenomenon is proposed by Bikhchandani et al. (1992). According to their view, prior mergers provide information about the profitability of those transactions. Thereby, it is optimal for the acquiring company's managers to factor in some of that external information provided by transactions in recent history in addition to the managers' own knowledge. Accordingly, the managers adjust their own evaluation of the appropriate size of the premium towards the average obtained from recent transactions in the market. Bikhchandani et al. (1992) label this dynamic as "information cascades", which effectively result in a momentum effect in acquisition premiums.

Rosen (2006) finds consistent empirical evidence on the underlying momentum in takeover premiums. One of the reasons the author proposes as a possible cause for the momentum effect is that the amount of expected synergies in all acquisitions can be commonly affected by external economic and regulatory shocks (see e.g. Mitchell and Mulherin, 1996; and Andrade et al., 2001). Positive shocks induce acquiring firms to bid more generously (and vice versa for negative shocks), resulting in an observable momentum in paid acquisition premiums. It is left without empirical support, however, whether the momentum effect in the premiums arises from changing levels of expected synergies (as proposed by Rosen, 2006), or whether the premiums' autocorrelative behavior is in fact independent of any synergy expectations.

Given the above discussion, I expect that takeover premiums exhibit autocorrelative behavior, i.e. momentum. Also, I hypothesize that the possible momentum effect is independent on expected operational synergies, measured by the similarity of the acquirer and the target company businesses. The first part of the third hypothesis is of confirmatory nature regarding Simonyan's (2014) and Rosen's (2006) results, while the latter part extends their analyses by studying whether Rosen's (2006) explanation for the momentum effect, i.e. that takeover premiums are steered by changing levels of expected synergies, can be observed empirically. The formal specification of the hypotheses reads as follows:

H3.1: The level of takeover premiums exhibits momentum.

H3.2: The momentum effect of takeover premiums is independent on expected operational synergies.

4 Data and variables

4.1 Data sample

I begin the sample collection by retrieving a panel data set for European corporate takeovers announced between January 2006 and September 2015, and recorded by October 2015 in Mergermarket[2] data base. The set of acquisitions in the panel is virtually exhaustive within the given time frame in the population of transactions with a target company domiciled in a European country. The total number of acquisitions in the data set is 26,454. From the selection, I exclude transactions which lack information about one or more of the following data points: exact offer price per share, market price per share prior to the announcement, target enterprise value, and method of payment. It is noteworthy that the exclusion of transactions for which the market price is not available also implicitly limits the sample to publicly listed target companies only. In addition, acquisitions which have been announced but not successfully completed are excluded from the data. After exclusions, the sample size of the set of transactions employed in the analysis is 2,082.

4.2 Variables

4.2.1 Takeover premiums

The size of takeover premiums (TOP) is defined as the difference between the offer price and the target company's latest closing market value prior to the deal announcement. The variable is converted to relative terms.

[2] See http://www.mergermarket.com/info/

$$TOP_i = \frac{Offer\ price\ per\ share_i - Price\ per\ share\ at\ latest\ market\ closing_i}{Price\ per\ share\ at\ latest\ market\ closing_i}$$

4.2.2 Industry classification & existence of expected operational synergies

Each transaction in the data set is labeled with an industry classification. More specifically, I establish a custom list of nineteen industries covering the most frequent business sectors. This classification constitutes a set of binary variables. Each of the variables gets a value of one for transactions where the class verbally converges Mergermarket database's (more fractionate) classification, and zero otherwise. The list of classes, their abbreviated notations, and frequencies in the sample are shown in the *Table 1: Industry classification*.

Expected operational synergies are assumed to exist if the sector classification for the target company and the acquirer verbally converge to each other. This relation is noted with a dummy variable 'Expected operational synergies' (EXS), which gets a value of one for acquisitions where expected operational synergies are assumed to exist, and zero otherwise. A more detailed discussion on the choice for the measure of expected operational synergies is provided in the '1.1 Research problem and purpose' and '3 Hypothesis development' sections of this paper.

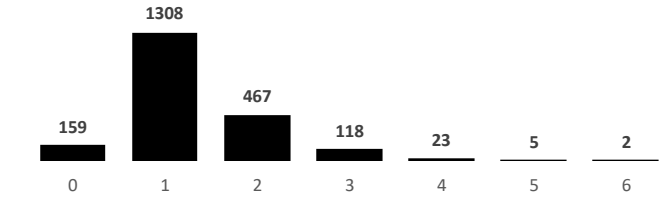
Table 1: Industry classification

Table presents the industry classification used in this study together with industry class variable abbreviations and class frequencies in the data sample. Each transaction in the data belongs in 0 – 6 industry classes. The distribution of transactions by the number of industries where the target company is present is presented in the bottom part of the table. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database.

Industry	Abbreviation	Frequency
Automotive	AUT	46
Biotechnology	BIO	47
Chemicals and materials	CHE	69
Computer software	COM	223
Construction	CON	128
Energy	ENE	223
Financial services	FIS	302
Industrial products	IND	224
Internet	INT	117
Leisure	LEI	88
Manufacturing other	MAN	84
Media	MED	99
Medical	MDC	150
Mining	MIN	66
Real estate	REE	175
Retail	RET	103
Services other	SER	347

Telecommunications	TEL	128
Transportation	TRP	106

Transactions by the number of industries where the target is present



4.2.3 Deal characteristics

The data set identifies a set of additional dummy variables to control for general deal characteristics with regards to transaction size, geography, investor type, form of consideration, and bid type. While most of the control variables are drawn from the results of the existing literature, the number of controlled factors is kept as limited to avoid overfitting and to maximize degrees of freedom for the statistical analyses.

The target company size is found to affect the size of acquisition premium (see e.g. Lambrecht, 2004; and Alexandridis et al., 2013). Thus, I control for the deal value with a variable 'Log enterprise value' (LEV), noting for the natural logarithm of the bid's total enterprise valuation for the target.

Geographical diversification of a transaction is also proposed to have an influence on the valuation (see e.g. Dos Santos et al., 2008). Geographic characteristics of the transactions are controlled with variables 'Cross boarder Europe' (CBE) and 'Transatlantic' (TRA), which get a value of one for transaction where the target and the acquirer are domiciled in different countries, and different continents, respectively, and zero otherwise.

E.g. Bargeron et al. (2008) find that the acquirer company type has a significant effect on the size of the premium. Investor type is therefore controlled with a dummy variable for nonstrategic (i.e. financial) buyers. The variable is labeled 'Financial investor' (FIN), and gets a value of one when the bidder represents the field of private equity or an equivalent industry, and zero otherwise.

The means of payment is also documented to affect the bid price (see e.g. Cheng et al., 2008; Ayers, et al., 2003; Amihud et al., 1990; and Travlos, 1987). Thus, the form of consideration is controlled with two dummy variables 'Equity payment' (EQP) and 'Mixed payment' (MIP),

which note for bids with a method of payment of sole equity and a mix of cash and equity, respectively. The variables get a value of one where the payment is of the given type, and zero otherwise. Transactions in which the method of payment consists of sole cash, are implicitly recognized by the residual of the two abovementioned variables. I.e., the payment includes only cash when both variables EQP and MIP get a value of zero.

Additionally, the bid type is controlled with two dummy variables indicating whether the bid is considered as hostile, and whether the acquisition has been reportedly rumored prior to the announcement. The variables are labeled as 'Hostile' (HOS) and 'Pre-rumored' (PRE), which get a value of one for hostile takeovers and pre-rumored takeovers, respectively, and zero otherwise.

4.2.4 Business cycle

Simonyan (2014) documents an inverse interdependency between takeover premiums and investor optimism. To control for changes in the general state of economy, I combine the transaction panel data with monthly Eurozone stock market index data, and quarterly changes in reported real Eurozone GDP, retrieved from S&P Capital IQ database[3]. Also, the data set is supplemented with daily reported three-month euribor rates, retrieved from Quandl[4] database. The variables for stock market index, change in real GDP, and euribor rates are labeled as 'Stock market index' (SMI), 'Change in GDP' (GDP), and 'Euribor' (EUR), respectively.

5 Methodology

5.1 Takeover premiums and expected operational synergies (H1)

The relationship between the existence of expected operational synergies and the size of takeover premiums is tested with a classical linear regression model (CLRM) in an ordinary least squares (OLS) domain. In the main model specification, the variable for takeover premiums (TOP) is regressed on the binary variable for expected operational synergies (EXS)

[3] See http://marketintelligence.spglobal.com/
[4] See https://www.quandl.com/

as an explanatory variable while controlling for deal characteristics and business cycle. The formal structure of the regression model (1) is as follows:

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \varepsilon_i \quad (1)$$

, where 'control variables' are:

2: $Cross\ border\ Europe\ (CBE)$
3: $Transatlantic\ (TRA)$
4: $Log\ enterprise\ value\ (LEV)$
5: $Financial\ investor\ (FIN)$
6: $Hostile\ (HOS)$
7: $Pre-rumoured\ (PRE)$
8: $Equity\ payment\ (EQP)$
9: $Mixed\ payment\ (MIP$
10: $Stock\ market\ index\ (SMI)$
11: $Change\ in\ GDP\ (GDP)$
12: $Euribor\ (EUR)$

Regression model (1) is linked to hypothesis H1. Given that the estimated regression coefficient for expected operational synergies (EXP) is statistically significant, hypothesis H1 is rejected.

5.2 Interindustry differences

5.2.1 Simple industry differences (H2.1)

Differences in the level of takeover premiums between different industries is analyzed by constructing a set of binary variables, each of which is designated for one of the nineteen industry classes. The joint significance of the industry dummies is tested with a standard F-test procedure. First, regression statistics are obtained from the estimated general regression model including all control variables and the industry dummies. The formal structure of the (unrestricted) regression model (2) is as follows:

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \varepsilon_i \quad (2)$$

, where 'industry variables' are:

13: $Automotive\ (AUT)$
14: $Biotechnology\ (BIO)$
15: $Chemicals\ and\ materials\ (CHE)$
16: $Computer\ software\ (COM)$
17: $Construction\ (CON)$
18: $Energy\ (ENE)$
19: $Financial\ services\ (FIS)$
20: $Industrial\ products\ (IND)$
21: $Internet\ (INT)$
22: $Leisure\ (LEI)$
23: $Manufacturing\ other\ (MAN)$
24: $Media\ (MED)$
25: $Medical\ (MDC)$
26: $Mining\ (MIN)$
27: $Real\ estate\ (REE)$
28: $Retail\ (RET)$
29: $Services\ other\ (SER)$
30: $Telecommunications\ (TEL)$
31: $Transportation\ (TRP)$

Subsequently, the model is restricted so that all industry variables are set equal. I.e.:

$$\beta_{13} = \beta_{14} = \cdots = \beta_{31}$$

Under null hypothesis, the test statistic (TS) is F-distributed (with degrees of freedom parameters m and T-k) and is obtained from regression statistics computed from the unrestricted and the restricted model estimations as follows:

$$TS = \frac{RRSS - URSS}{URSS} * \frac{T - k}{m} \sim F(m, T - k)$$

, where

$URSS = Residual\ sum\ of\ squares\ from\ unrestricted\ regression$
$RRSS = Residual\ sum\ of\ squares\ from\ restricted\ regression$
$m = number\ of\ restrictions$
$T = number\ of\ observations$
$k = number\ of\ regressors\ in\ unrestricted\ regression\ (including\ constant)$

The F-test is linked to hypothesis H2.1. Accordingly, given that a test statistic greater than the appropriate critical value is observed, hypothesis H2.1 is rejected.

5.2.2 Industry-differences and expected operational synergies (H2.2)

Whether the dependency between premiums and expected operational synergies is independent on the target company industry is analyzed by extending the estimated regression model with interaction variables for joint effects between individual industry variables and the expected synergy variable. The formal specification of the estimated regression model (3) including control variables, industry main effects, and interaction terms between industries and expected synergies is as follows.

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \sum_{l=32}^{50} \beta_l interaction\ term_{(l-19)\_EXS,i} + \varepsilon_i \quad (3)$$

, where

‘interaction terms’ are binary interaction variables between expected operational synergies (EXS) and industry variables 13, 14, …, 31.

Joint significance of the interaction variables is tested with an alike F-test (see section '5.2.1 Simple industry differences (H2.1)' above). However, the restricted regression model under estimation is modified so that instead of restricting the main effects, the beta coefficient for the interaction terms are restricted while the main effects are left unrestricted. This F-test is linked to hypothesis H2.2. I.e., given that a test statistic greater than the appropriate critical value is observed, hypothesis H2.2 is rejected.

5.3 Momentum effect

Rosen (2006) analyzes the momentum effect in takeover premiums by including multiple lagged regressors in the estimated regression model. These variables include e.g. 'trailing 12-month average CAAR (of the target)' 'trailing 12-month return on CRSP index', 'trailing 12-month return on bidder's stock' etc. Simonyan (2014) adopts a similar approach and includes various variables for trailing stock market returns and investor sentiment.

A pronounced issue in this methodology is that the explanatory variables used to identify momentum tend to be highly correlated with each other. The multicollinearity in the regression models makes the estimated regression coefficients considerably unstable. In other words, they may change erratically in response to minor changes in the model or the used data, which further makes the interpretation of the estimated regression coefficients problematic. Therefore, in this study, I extend the analysis by converting the data panel into a time series of sequential transactions, and quarterly averages when appropriate, and study the autocorrelative properties of those time series.

5.3.1 Overall momentum effect (H3.1)

The overall existence of momentum is tested for individual transactions assumed to occur in a time sequence with equal intervals. The test follows Breusch-Godfrey procedure for testing k:th order autocorrelation. Specifically, I obtain the estimated error terms from the regression model (2) and regress the residuals on lagged error terms (up to r:th order) in addition to all regressors from the original model. The formal specification of the test regression is as follows:

$$\hat{\varepsilon}_t = \beta_0 + \beta_1 EXS_t + \sum_{j=2}^{12} \beta_j control\ variable_{t,j} + \sum_{k=13}^{31} \beta_k industry\ variable_{t,k} + \sum_{l=1}^{r} \rho_l \hat{\varepsilon}_{t-l} + u_t \quad (4)$$

, where

$\hat{\varepsilon}_{t-1}, \hat{\varepsilon}_{t-2}, \dots, \hat{\varepsilon}_{t-r}\ note\ for\ lagged\ residuals\ (up\ to\ r{:}\ th\ order)\ from\ model\ (2)$

The purpose of this is to identify whether the lagged residuals have notable power in predicting the (current) residual, or in other words, whether the original model exhibits autocorrelation. Under null hypothesis, the test statistic, calculated by multiplying the obtained R^2 of the test regression by the difference of sample size and r, is χ^2 distributed with degrees of freedom parameter r:

$$TS = (T - r)R^2 \sim \chi^2(r)$$

, where

$T = number\ of\ observations$
$r = highest\ order\ of\ lagged\ residuals$
$R^2 = R - squared\ of\ the\ estimated\ regression\ model\ (4)$

The test is linked to hypothesis H3.1. Accordingly, if the test statistic (TS) has a value greater than the appropriate critical value, I fail to reject hypothesis H3.1.

5.3.2 Momentum and expected operational synergies (H3.2)

In order to analyze the momentum effect's dependency on the expected operational synergies, a suitable autoregressive moving average (ARMA) model is estimated for the time series by plotting the autocorrelation coefficients and testing their individual statistical significances with standard confidence intervals, following Box Jenkins (1976) approach. The confidence intervals are calculated as follows:

$$0 \pm z_{1-\frac{\alpha}{2}}\sqrt{Var(\hat{\rho}_k)},$$

$$Var(\hat{\rho}_k) = \frac{1}{T}\left(1 + 2\sum_{i=1}^{T}\hat{\rho}_i\right), k > T$$

, where

$z\ is\ the\ cumulative\ distribution\ function\ (CDF)\ of\ standard\ normal\ distribution$
$\alpha\ is\ the\ significance\ level$
$\hat{\rho}_k = estimated\ autocorrelation\ coefficient\ (of\ order\ k)$
$k\ notes\ for\ the\ given\ lag\ order$
$T = number\ of\ observations$

Given these results, an ARMA model with the appropriate number of lagged terms (drawn from the significance of the autocorrelation coefficients in the previous phase) is estimated. The formal specification of the ARMA(p, q) model is as follows:

$$TOP_t = \mu + \sum_{i=1}^{p}\phi_i TOP_{t-i} + \sum_{j=1}^{q}\theta_j\varepsilon_{t-j} + \varepsilon_t \quad (5)$$

, where

$p, q = highest\ order\ of\ statistically\ significant\ AC\ coefficients\ in\ pooled\ model$

In this study, it is in my special interest to identify the momentum effect's dependency on expected operational synergies, whereas other variables' potential influence on the momentum is of only secondary interest. Therefore, I exclude all regressors other than the autoregressive (AR) and the moving average (MA) terms from the estimated regression model, and subsequently compare two subgroups, with and without expected operational synergies, to each other. The formal specification of the two models are the following:

a)

$$TOP_{a,t} = \mu_a + \sum_{i=1}^{p} \phi_{i,a} TOP_{a,t-i} + \sum_{j=1}^{q} \theta_{j,a} u_{t-j} + u_t \quad (6)$$

and

b)

$$TOP_{b,t} = \mu_b + \sum_{i=1}^{p} \phi_{i,b} TOP_{b,t-i} + \sum_{j=1}^{q} \theta_{j,b} v_{t-j} + v_t \quad (7)$$

, where

$p, q = highest\ order\ of\ statistically\ significant\ AC\ coefficients\ in\ pooled\ model$
$a, b\ note\ for\ EXS = 1\ and\ EXS = 0, respectively$

Parameter stability between the two models is tested with Chow's test. Accordingly, maximum likelihood estimates for autoregressive coefficients $\phi_1, \phi_2, \dots, \phi_k$ and moving average coefficients $\theta_1, \theta_2, \dots, \theta_k$ for models (6) and (7) are computed. The estimated coefficients are hypothesized to be simultaneously equal. I.e.:

$$\mu_a = \mu_b\ and\ \phi_{l,a} = \phi_{l,b}\ and\ \theta_{l,a} = \theta_{l,b}\ \forall\ 1 \leq l \leq k$$

Restrictions in the null hypothesis are tested with an F-test where the unrestricted regression comes in two parts, one for each sub sample, i.e. models (6) and (7).

With regards to the restricted model, as the coefficient estimates are drawn from periodic averages, the restricted model does not exactly equate with the pooled model, but instead combines models (6) and (7) so that both averages from the two subgroups, with and without expected operational synergies, are considered sequentially. This is required for technical comparability between residual sums of squares between the models. To help understand this,

let us hypothetically consider that the pooled model would in fact be employed as the restricted model instead of the sequential combination of the two submodels. Then, each period would have a larger number of transactions resulting in a lower standard deviation among the periodic averages. This would artificially decrease the residual sum of squares in the restricted model, which would make the Chow-test for parameter stability powerless in identifying any significant differences between the subgroups.

The test statistic (TS) follows F-distribution (with degrees of freedom parameters k and T-2k) and is calculated as follows:

$$TS = \frac{RSS - (RSS_a + RSS_b)}{RSS_a + RSS_b} * \frac{T - 2k}{k} \sim F(k, T - 2k)$$

, where

$RSS = Residual\ sum\ of\ squares\ from\ the\ restricted\ model$
$RSS_a = Residual\ sum\ of\ squares\ from\ model$ (6)
$RSS_b = Residual\ sum\ of\ squares\ from\ model$ (7)
$T = number\ of\ observations$
$k = number\ of\ regressors\ in\ model$ (5) $(including\ constant)$

In addition to the Chow's test, I also test whether the individual coefficients significantly differ from each other between models (6) and (7). The test follows a Z-test procedure introduced by Clogg et al. (1995). Accordingly, each estimated regression coefficient in model (6) is hypothesized to be equal with the corresponding coefficients in model (7) separately. Under null hypothesis, the test statistic Z follows the standard normal distribution, and is calculated as follows:

$$Z = \frac{\beta_a - \beta_b}{\sqrt{(SE\beta_a)^2 + (SE\beta_b)^2}} \sim N(0,1)$$

, where

$\beta_a, \beta_b\ note\ for\ estimated\ coefficients\ in\ moodels$ (6) and (7), $respectively$

$SE(.)$ *notes for standard error*

The Chow's test and the Z-tests for individual coefficients are linked to hypothesis H3.2. Accordingly, if the test statistic in the Chow's test has a value greater than the appropriate critical value, and the individual coefficients for lagged terms are significant, hypothesis H3.2. is rejected.

6 Results

This section presents the quantitative results of this study. I start by showing summary sample statistics, and subsequently proceed to presenting step-by-step results for the statistical tests specified in section '5 Methodology' above. Discussion on the central outcomes is positioned after brief narratives of the technical results in three parts, namely takeover premiums and expected operational synergies, interindustry differences, and momentum effect. The discussion sections also present the preliminary conclusions for hypotheses H1, H2.1 and H2.2, and H3.1 and H3.2.

The summary sample statistics are presented in *Table 2: Summary sample statistics*. The mean takeover premium (TOP) in the sample is 25.2% with a standard deviation of 35.3%. The median premium is 15.3%. Expected operational synergies (EXS) are deemed to be present in 78.7% of the transactions in the sample.

Pearson correlation coefficients between all variables are presented in *Table 3: Variable pairwise correlations*. A general conclusion with regards to pairwise correlations is that few variables exhibit strong correlation. The strongest correlations are observed between the set of business cycle control variables. Therefore, their estimated regression coefficients can be somewhat unstable, and as a result, are difficult to interpret. However, business cycle variables' purpose is not to represent standalone relationship between the business cycle and takeover premiums but to jointly control for the effect. Therefore, the multicollinearity does not affect the results of this study. Other pairs of variables with a notable positive correlation include industry binaries for biotechnology (BIO) and medical (MDC), and internet (INT) and telecommunication (TEL). The reason for positive correlation is that many companies in the industry classification are deemed to belong in both industries. Again, this mainly affects the

standard errors of the estimated individual beta coefficients, and not their joint power as control variables. It is also noteworthy that many industries are generally exclusive, resulting in slight negative correlation coefficient between these industry pairs as well as between other mutually exclusive control variables.

Table 2: Summary sample statistics

The table presents the descriptive statistics for a sample of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of *takeover premiums* (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable *Expected operational synergies* (EXS) note for transactions where the acquirer and the target operate in the same industry sector. Target company industry is noted with a set of industry classification dummies, *Automotive* (AUT), *Biotechnology* (BIO), *Chemicals and materials* (CHE), *Computer software* (COM), *Construction* (CON), *Energy* (ENE), *Financial services* (FIS), *Industrial products* (IND), *Internet* (INT), *Leisure* (LEI), *Manufacturing other* (MAN), *Media* (MED), *Medical* (MDC), *Mining* (MIN), *Real estate* (REE), *Retail* (RET), *Services other* (SER), *Telecommunications* (TEL), and *Transportation* (TRP). Geographical reach of the transaction is classified with a set of geographic dummies, *Cross border Europe* (CBE), and *Transatlantic* (TRA). Variable *Log enterprise value* (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable *Financial investor* (FIN). Method of payment is noted with a set of dummy variables *Equity payment* (EQP), and *Mixed payment* (MIP). Dummy variable *Hostile* (HOS) notes for bids that are considered as hostile. Dummy variable *Pre-rumored* (PRE) notes for pre-rumored bids. Business cycle related variables *Stock market index* (SMI), *Change in GDP* (GDP), and *Euribor* (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Combinations of variable EXS and industry class dummies note for the given variables' joint occurrence.

					Percentile				
Variable	**Abbreviation**	**Type**	**Mean**	**SD**	**5%**	**25%**	**50%**	**75%**	**95%**
Takeover premiums	TOP	continuous	0.252	0.353	0.005	0.054	0.153	0.321	0.803
Expected synergies	EXS	binary	0.787	0.409					
Cross border Europe	CBE	binary	0.393	0.489					
Transatlantic	TRA	binary	0.152	0.359					
Log enterprise value	LEV	continuous	5.693	2.053	2.638	4.107	5.580	7.162	9.325
Financial investor	FIN	binary	0.102	0.302					
Hostile	HOS	binary	0.031	0.173					
Pre-rumoured	PRE	binary	0.241	0.428					
Equity payment	EQP	binary	0.088	0.283					
Mixed payment	MIP	binary	0.058	0.234					
Stock market index	SMI	continuous	788.316	152.197	552.079	656.750	804.640	896.610	1037.790
Change in GDP	GDP	continuous	0.003	0.007	-0.006	-0.001	0.004	0.006	0.011
Euribor	EUR	continuous	2.067	1.777	0.048	0.330	1.423	3.891	4.941
Automotive	AUT	binary	0.022	0.147					
Biotechnology	BIO	binary	0.023	0.149					
Chemicals and materials	CHE	binary	0.033	0.179					
Computer software	COM	binary	0.107	0.309					
Construction	CON	binary	0.061	0.240					
Energy	ENE	binary	0.107	0.309					
Financial services	FIS	binary	0.145	0.352					
Industrial products	IND	binary	0.108	0.310					
Internet	INT	binary	0.056	0.230					
Leisure	LEI	binary	0.042	0.201					

Manufacturing other	MAN	binary	0.040	0.197
Media	MED	binary	0.048	0.213
Medical	MDC	binary	0.072	0.259
Mining	MIN	binary	0.032	0.175
Real estate	REE	binary	0.084	0.278
Retail	RET	binary	0.049	0.217
Services other	SER	binary	0.167	0.373
Telecommunications	TEL	binary	0.061	0.240
Transportation	TRP	binary	0.051	0.220
EXS_Automotive	EXS_AUT	binary	0.019	0.136
EXS_Biotechnology	EXS_BIO	binary	0.015	0.123
EXS_Chemicals and materials	EXS_CHE	binary	0.022	0.147
EXS_Computer software	EXS_COM	binary	0.076	0.265
EXS_Construction	EXS_CON	binary	0.042	0.200
EXS_Energy	EXS_ENE	binary	0.085	0.278
EXS_Financial services	EXS_FIS	binary	0.135	0.342
EXS_Industrial products	EXS_IND	binary	0.085	0.279
EXS_Internet	EXS_INT	binary	0.040	0.196
EXS_Leisure	EXS_LEI	binary	0.030	0.170
EXS_Manufacturing other	EXS_MAN	binary	0.028	0.166
EXS_Media	EXS_MED	binary	0.040	0.197
EXS_Medical	EXS_MDC	binary	0.056	0.230
EXS_Mining	EXS_MIN	binary	0.023	0.150
EXS_Real estate	EXS_REE	binary	0.061	0.240
EXS_Retail	EXS_RET	binary	0.033	0.179
EXS_Services other	EXS_SER	binary	0.130	0.336
EXS_Telecommunications	EXS_TEL	binary	0.043	0.202
EXS_Transportation	EXS_TRP	binary	0.037	0.189

Table 3: Variable pairwise correlations

Table presents the pairwise correlation between all variables in the sample of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. Geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP).

	TOP	CBE	TRA	LEV	FIN	EXS	HOS	PRE	EQP	MIP	SMI	GDP	EUR	AUT	BIO	CHE	COM	CON	ENE	FIS	IND	INT	LEI	MAN	MED	MDC	MIN	REE	RET	SER	TEL	TRP
TOP	1.00																															
CBE	0.03	1.00																														
TRA	0.06	-0.34	1.00																													
LEV	-0.13	0.16	0.01	1.00																												
FIN	-0.05	-0.03	0.02	0.04	1.00																											
EXS	0.00	0.02	0.01	-0.02	-0.33	1.00																										
HOS	-0.03	-0.01	0.02	0.03	-0.01	0.01	1.00																									
PRE	-0.15	-0.02	0.05	0.14	0.01	0.08	0.02	1.00																								
EQP	-0.01	-0.09	-0.06	0.00	-0.06	0.07	0.01	0.06	1.00																							
MIP	-0.03	-0.03	0.02	0.09	-0.06	0.08	0.05	0.10	-0.08	1.00																						
SMI	-0.15	0.01	-0.03	0.11	0.03	0.03	-0.02	-0.01	-0.07	0.04	1.00																					
GDP	-0.13	-0.02	0.02	0.05	0.03	0.03	-0.01	-0.02	-0.03	0.04	0.65	1.00																				
EUR	-0.05	-0.02	-0.04	0.05	0.03	0.03	0.00	-0.01	-0.04	-0.04	0.45	0.17	1.00																			
AUT	0.07	0.00	0.01	0.03	-0.03	0.02	0.05	0.02	0.01	-0.02	-0.04	-0.01	-0.01	1.00																		
BIO	0.02	0.00	0.07	-0.04	-0.02	-0.04	-0.03	-0.02	-0.01	0.02	-0.04	0.00	-0.03	-0.02	1.00																	
CHE	-0.02	0.05	0.00	0.07	-0.02	-0.05	0.00	-0.04	-0.02	-0.03	-0.01	-0.03	0.02	-0.03	-0.01	1.00																
COM	0.05	-0.08	0.14	-0.20	0.03	-0.07	-0.03	-0.05	-0.02	-0.01	0.00	0.01	0.01	-0.03	-0.04	-0.06	1.00															
CON	-0.05	0.02	-0.02	0.14	0.02	-0.07	-0.01	0.00	-0.02	-0.01	-0.01	-0.02	0.01	0.03	-0.04	0.00	-0.09	1.00														
ENE	0.01	0.05	-0.05	0.12	-0.07	0.00	0.01	0.03	0.04	-0.01	-0.05	-0.07	0.00	-0.05	-0.04	0.03	-0.11	-0.06	1.00													
FIS	-0.05	-0.02	-0.03	0.07	0.05	0.14	0.01	0.03	0.11	0.04	0.01	0.02	0.04	-0.02	-0.06	-0.08	-0.12	-0.07	-0.11	1.00												
IND	-0.03	-0.02	0.03	0.02	0.02	0.00	0.02	0.01	-0.01	-0.02	-0.04	-0.01	-0.01	0.15	-0.05	0.00	-0.08	0.10	0.01	-0.12	1.00											
INT	0.01	-0.04	0.00	-0.01	-0.01	-0.05	0.02	-0.03	0.01	0.01	0.01	0.02	-0.01	-0.04	-0.04	-0.05	0.04	-0.06	-0.07	-0.04	-0.08	1.00										
LEI	-0.03	0.02	-0.01	-0.03	-0.02	-0.04	-0.04	0.03	-0.01	-0.02	0.04	0.05	-0.01	-0.03	-0.03	-0.04	0.00	-0.05	-0.07	-0.09	-0.07	0.06	1.00									
MAN	-0.05	-0.02	-0.01	-0.03	0.01	-0.04	0.01	-0.04	-0.04	-0.02	0.00	0.00	-0.02	0.00	-0.01	0.10	-0.05	0.07	-0.03	-0.08	0.05	-0.03	-0.03	1.00								
MED	0.06	-0.01	0.01	-0.03	-0.03	0.03	0.00	0.00	0.00	0.00	0.02	0.01	0.01	0.00	-0.03	-0.04	-0.03	-0.06	-0.07	-0.05	-0.06	0.11	0.00	-0.03	1.00							
MDC	0.01	0.02	0.03	-0.02	0.03	0.00	0.01	-0.01	0.01	0.01	-0.01	0.01	-0.03	-0.04	0.38	0.02	-0.09	-0.04	-0.09	-0.10	-0.09	-0.06	-0.06	-0.05	-0.06	1.00						
MIN	-0.01	0.04	0.01	0.00	-0.01	-0.03	0.03	0.03	0.12	0.00	-0.04	-0.04	-0.01	-0.03	-0.03	0.04	-0.06	-0.03	-0.02	-0.05	0.01	-0.04	-0.04	0.00	-0.04	-0.05	1.00					
REE	-0.01	-0.05	-0.06	0.11	-0.04	-0.04	0.02	-0.04	0.05	-0.02	0.00	-0.06	-0.01	-0.02	-0.05	-0.06	-0.10	0.06	-0.07	0.08	-0.06	-0.07	-0.03	-0.04	-0.05	-0.08	-0.03	1.00				
RET	-0.05	-0.02	-0.04	0.01	0.05	-0.07	0.01	0.07	-0.02	-0.03	0.08	0.02	0.04	-0.02	-0.03	-0.02	-0.07	-0.02	-0.06	-0.08	-0.07	0.02	0.02	-0.04	-0.03	-0.02	-0.04	-0.03	1.00			
SER	0.02	-0.07	0.02	-0.09	0.09	-0.01	0.00	0.05	-0.08	0.03	0.00	-0.02	0.06	-0.03	-0.05	-0.01	0.06	0.06	-0.03	-0.07	0.04	-0.01	-0.05	-0.01	0.05	-0.05	-0.07	-0.07	-0.01	1.00		
TEL	-0.04	0.00	0.02	0.18	0.04	-0.06	0.00	0.01	0.00	0.00	-0.01	0.01	-0.04	-0.02	-0.04	-0.05	0.01	-0.01	-0.05	-0.10	0.00	0.33	-0.04	-0.04	0.05	-0.07	-0.02	-0.05	-0.05	0.00	1.00	
TRP	0.02	0.03	-0.05	0.09	0.02	-0.03	0.00	0.02	0.01	0.00	-0.01	-0.01	-0.03	-0.02	-0.04	-0.04	-0.07	0.10	-0.02	-0.06	-0.05	-0.06	-0.02	-0.05	-0.03	-0.06	-0.04	-0.04	-0.04	0.08	-0.01	1.00

6.1 Takeover premiums and expected operational synergies

Results for the estimated model (1) provide evidence that expected operational synergies (EXS) do not have significant power in explaining takeover premiums (TOP). The estimated beta coefficient for expected operational synergies (EXS) is -0.002 with an estimated standard error of 0.020 and a p-value of 0.920. To be statistically significant at the conventional significance level of 5%, the coefficient would have to be about twenty times larger (in absolute terms) than what the results imply.

Estimated coefficients for geographic control variables, cross border Europe (CBE) and transatlantic (TRA), 0.056 and 0.092, respectively, are highly significant. Also, log enterprise value (LEV) has a highly significant coefficient of -0.018. Dummy variable for pre-rumored deals (PRE) is highly significant, with an estimated coefficient of -0.118. From business cycle variables, stock market index (SMI) and change in GDP (GDP) are significant, while euribor (EUR) does not produce a significant coefficient. Other control variables, including indicators for financial investor (FIN), hostile takeovers (HOS), and methods of payment comprising two variables, equity payment (EQP) and mixed payment (MIP), do not produce statistically significant regression coefficients.

Full results for estimated model (1) are shown in *Table 4: Results for cross-sectional regression model (1).*

Table 4: Results for cross-sectional regression model (1)

Table presents the results for the cross-sectional OLS regression model (1) with the following specification:

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \varepsilon_i$$

The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively.

Variable		**Coefficient**	**Std.Err.**	**t-Stat.**	**P-value**	**Lower95%**	**Upper95%**	**Significance**
Constant		0.550	0.057	9.683	0.000	0.439	0.662	***
Expected synergies	EXS	-0.002	0.020	-0.100	0.920	-0.040	0.036	
Cross border Europe	CBE	0.056	0.017	3.329	0.001	0.023	0.089	***
Transatlantic	TRA	0.092	0.022	4.081	0.000	0.048	0.136	***
Log enterprise value	LEV	-0.018	0.004	-4.788	0.000	-0.026	-0.011	***
Financial investor	FIN	-0.042	0.026	-1.612	0.107	-0.094	0.009	
Hostile	HOS	-0.048	0.043	-1.106	0.269	-0.133	0.037	
Pre-rumoured	PRE	-0.118	0.018	-6.592	0.000	-0.153	-0.083	***
Equity payment	EQP	0.004	0.027	0.151	0.880	-0.049	0.057	
Mixed payment	MIP	0.005	0.033	0.161	0.872	-0.059	0.069	
Stock market index	SMI	0.000	0.000	-3.366	0.001	0.000	0.000	***
Change in GDP	GDP	-3.228	1.494	-2.161	0.031	-6.157	-0.298	**
Euribor	EUR	0.004	0.005	0.896	0.370	-0.005	0.014	

Regression statistics	**R-Squared**	**Adj.R-Sqr.**	**Std.Err.Reg.**	**Std. Dev.**	**N**
	0.069	0.063	0.341	0.353	2080

Analysis of Variance

Source	**df**	**Sum Sqrs.**	**F**	**P-value**
Regression	12	17.725	12.670	0.000
Residual	2067	240.976		
Total	2079	258.701		

6.1.1 Discussion: Takeover premiums and expected operational synergies

Given the abovementioned evidence, I fail to reject hypothesis H1, and conclude that expected operational synergies generally do not explain the level of takeover premiums. The results are consistent with Slusky and Caves (1991), and Gondhalekar et al. (2004).

The observed independency between the premiums and the expected synergies suggests that corporate takeovers are generally driven by motives other than maximization of shareholder value. While it is not explicitly studied in this paper, existing financial literature suggests that much of the excess mergers and acquisitions activity is attributable to the managers' personal benefits, such as increased compensation, job security, and social status (see e.g. Trautwein, 1990). Besides the volume, it is likely that the size of the premiums is likewise affected. In addition to acting in their own, rather than the shareholders', benefit, it is possible that the managers simply fall in love with the idea of a given acquisition, and subsequently fail to reject the acquisition plan even though a more rigorous analysis would reveal that the numbers do not add up (see e.g. Eccles et al., 1999).

Besides private benefits, another motive for carrying out acquisitions might stem from long-term strategic reasons. In this case, the value-add to the acquirer shareholders would not necessarily be imminently reflected in the share price but gradually surfaces going forward. Undoubtedly, strategic features are often present in takeovers where the acquirer is expanding geographically. Interestingly, the data provides evidence that cross-border acquisitions appear to be valued more generously in terms of the premiums. Furthermore, the longer is the distance between the acquirer and the target company domiciles the higher are the premiums.

Given the observed premium for geographic diversification, it is possible that managers are generally willing to pay for the strategic value created via the acquisition. It is noteworthy, however, that while the managers might be sincere in their efforts to create shareholder value, it appears that their assessment, on average, is miscalibrated and overconfident. Thus, in the majority of acquisitions, the long-term value add tends to not materialize. This is suggested by results in the existing literature that acquiring firms, on average, destroy value from the acquiring company shareholders' point of view, particularly when high premiums are paid (see e.g. Fuller et al., 2002; and Krishnan et al., 2007).

Also, other possible reasons exist for the higher level of takeover premiums when the acquirer and the target are domiciled in different countries. These reasons include financial arbitrage such as tax advantages and exploiting imperfect capital markets, among others. Accordingly, it

is possible that financial synergies have some power in explaining the takeover premiums, unlike those in the operational domain. As the similarity measure for expected operational synergies employed in this study is poorly apt to capture any financial synergies, financial synergies' role as a determinant of takeover premiums is left undecided, to the extent of this study.

6.2 Interindustry differences

6.2.1 Simple industry differences

With regards to results for the F-test with parameter restrictions for industry variables, the F-statistic 2.435 (degrees of freedom: 18, 2048) is highly significant with a p-value of 0.001. I.e. the industry classification (jointly) has significant power in explaining takeover premiums (TOP).

Estimated regression statistics for the unrestricted model (2) are presented in *Table 5: Results for cross-sectional regression model (2)*. Among industry variables, a coefficient of 0.171 for automotive (AUT) is statistically highly significant. Other significant determinants include financial services (FIS), manufacturing, other (MAN), and media (MED), with coefficients of -0.049, -0.091, and 0.086, respectively. A weak significance is observed for construction (CON) and industrial products (IND) coefficients -0.055 and -0.049, respectively. Coefficients for other industry variables are insignificant.

Introducing the set of industry variables does not notably change estimated coefficients for expected operational synergies (EXS) and control variables. Likewise in model (1), the estimated coefficient for expected operational synergies (EXS), -0.005, is insignificant. Coefficients for cross border Europe (CBE), transatlantic (TRA), log enterprise value (LEV), pre-rumored (PRE), stock market index (SMI), and change in GDP (GDP) are significant. Other control variables, including financial investor (FIN), hostile (HOS), equity payment (EQP), and mixed payment (MIP), are insignificant.

Table 5: Results for cross-sectional regression model (2)

Table presents the results for the cross-sectional OLS regression model (2) with the following specification:

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \varepsilon_i$$

The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP).

Variable		**Coefficient**	**Std.Err.**	**t-Stat.**	**P-value**	**Lower95%**	**Upper95%**	**Significance**
Constant		0.553	0.059	9.428	0.000	0.438	0.668	***
Expected synergies	EXS	-0.005	0.020	-0.229	0.819	-0.044	0.035	
Cross border Europe	CBE	0.055	0.017	3.269	0.001	0.022	0.088	***
Transatlantic	TRA	0.089	0.023	3.889	0.000	0.044	0.133	***
Log enterprise value	LEV	-0.016	0.004	-3.927	0.000	-0.024	-0.008	***
Financial investor	FIN	-0.033	0.027	-1.252	0.211	-0.086	0.019	
Hostile	HOS	-0.054	0.043	-1.252	0.211	-0.139	0.031	
Pre-rumoured	PRE	-0.118	0.018	-6.549	0.000	-0.153	-0.082	***
Equity payment	EQP	0.007	0.027	0.265	0.791	-0.046	0.061	
Mixed payment	MIP	0.003	0.033	0.088	0.930	-0.061	0.067	
Stock market index	SMI	0.000	0.000	-3.322	0.001	0.000	0.000	***
Change in GDP	GDP	-3.158	1.496	-2.111	0.035	-6.092	-0.224	**
Euribor	EUR	0.004	0.005	0.859	0.390	-0.005	0.014	
Automotive	AUT	0.171	0.052	3.303	0.001	0.070	0.273	***
Biotechnology	BIO	-0.015	0.055	-0.265	0.791	-0.122	0.093	
Chemicals and materials	CHE	-0.044	0.043	-1.025	0.306	-0.128	0.040	
Computer software	COM	0.010	0.027	0.358	0.720	-0.043	0.062	
Construction	CON	-0.055	0.032	-1.715	0.087	-0.119	0.008	*
Energy	ENE	0.008	0.026	0.307	0.759	-0.043	0.059	
Financial services	FIS	-0.049	0.024	-2.073	0.038	-0.096	-0.003	**
Industrial products	IND	-0.049	0.026	-1.927	0.054	-0.099	0.001	*
Internet	INT	0.021	0.035	0.594	0.553	-0.048	0.090	
Leisure	LEI	-0.052	0.038	-1.361	0.174	-0.128	0.023	
Manufacturing other	MAN	-0.091	0.039	-2.340	0.019	-0.167	-0.015	**
Media	MED	0.086	0.036	2.375	0.018	0.015	0.156	**
Medical	MDC	0.000	0.033	0.004	0.997	-0.065	0.065	
Mining	MIN	-0.036	0.044	-0.823	0.411	-0.123	0.050	
Real estate	REE	0.010	0.029	0.350	0.726	-0.046	0.066	
Retail	RET	-0.056	0.036	-1.570	0.116	-0.127	0.014	
Services other	SER	0.011	0.021	0.548	0.584	-0.029	0.052	
Telecommunications	TEL	-0.053	0.034	-1.541	0.123	-0.121	0.014	
Transportation	TRP	0.044	0.036	1.231	0.218	-0.026	0.114	

Regression statistics	**R-Squared**	**Adj.R-Sqr.**	**Std.Err.Reg.**	**Std. Dev.**	**N**
	0.088	0.074	0.339	0.353	2080

Analysis of Variance

Source	**df**	**Sum Sqrs.**	**F**	**P-value**
Regression	31	22.841	6.398	0.000
Residual	2048	235.860		
Total	2079	258.701		

6.2.2 Industry-differences and expected operational synergies

The test statistic for the F-test with parameter restrictions for interaction terms between expected operational synergies (EXS) and the industry variables is 1.732 (degrees of freedom: 18, 2029). The F-statistic is statistically significant with a p-value of 0.028. Thus, the interaction terms (jointly) have significant power in explaining takeover premiums (EXS).

Estimated regression statistics for the unrestricted model (3) are presented *Table 6: Results for cross-sectional regression model (3).* Among the interaction terms, the coefficient for real estate (EXS_REE), -0.225, is highly significant. Also, the coefficient for automotive (EXS_AUT), -0.307, is significant. Other interaction terms are individually insignificant.

Inclusion of the interaction terms does not change estimated coefficients for expected operational synergies (EXS) and control variables considerably. The estimated coefficient for expected operational synergies (EXS) is 0.015 and insignificant. Likewise in models (1) and (2), cross border Europe (CBE), transatlantic (TRA), log enterprise value (LEV), pre-rumored (PRE), stock market index (SMI), and change in GDP (GDP) are statistically significant. Other control variables, financial investor (FIN), hostile (HOS), equity payment (EQP), and mixed payment (MIP), are insignificant.

Estimated coefficients for the industry main effects, however, alter slightly when the interaction terms are included. Among industry main effect variables in the unrestricted model (3), variables for automotive (AUT) and real estate (REE) are highly significant, with estimated coefficients of 0.425 and 0.175, respectively.

Table 6: Results for cross-sectional regression model (3)

Table presents the results for the cross-sectional OLS regression model (3) with the following specification:

$$TOP_i = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \sum_{l=32}^{50} \beta_l interaction\ term_{(l-19)\_EXS,i} + \varepsilon_i$$

The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy

variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP). Combinations of variable EXS and industry class dummies note for the given variables' joint occurrence, i.e. interaction terms.

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		0.539	0.064	8.368	0.000	0.413	0.666	***
Expected synergies	EXS	0.015	0.039	0.400	0.689	-0.060	0.091	
Cross border Europe	CBE	0.054	0.017	3.189	0.001	0.021	0.087	***
Transatlantic	TRA	0.089	0.023	3.882	0.000	0.044	0.133	***
Log enterprise value	LEV	-0.016	0.004	-3.919	0.000	-0.024	-0.008	***
Financial investor	FIN	-0.022	0.028	-0.782	0.434	-0.076	0.033	
Hostile	HOS	-0.045	0.043	-1.040	0.299	-0.130	0.040	
Pre-rumoured	PRE	-0.118	0.018	-6.596	0.000	-0.154	-0.083	***
Equity payment	EQP	0.014	0.027	0.500	0.617	-0.040	0.067	
Mixed payment	MIP	0.006	0.033	0.184	0.854	-0.058	0.070	
Stock market index	SMI	0.000	0.000	-3.438	0.001	0.000	0.000	***
Change in GDP	GDP	-2.784	1.498	-1.858	0.063	-5.722	0.154	*
Euribor	EUR	0.004	0.005	0.832	0.405	-0.005	0.013	
Automotive	AUT	0.425	0.131	3.247	0.001	0.168	0.681	***
Biotechnology	BIO	-0.073	0.094	-0.771	0.441	-0.258	0.112	
Chemicals and materials	CHE	-0.050	0.076	-0.662	0.508	-0.198	0.098	
Computer software	COM	0.067	0.051	1.306	0.192	-0.034	0.168	
Construction	CON	-0.070	0.060	-1.161	0.246	-0.187	0.048	
Energy	ENE	-0.017	0.057	-0.294	0.769	-0.128	0.095	
Financial services	FIS	-0.058	0.079	-0.734	0.463	-0.212	0.097	
Industrial products	IND	0.006	0.056	0.111	0.912	-0.104	0.116	
Internet	INT	0.107	0.065	1.644	0.100	-0.021	0.235	
Leisure	LEI	-0.128	0.072	-1.783	0.075	-0.269	0.013	*
Manufacturing other	MAN	-0.122	0.073	-1.658	0.097	-0.265	0.022	*
Media	MED	-0.049	0.093	-0.522	0.602	-0.232	0.135	
Medical	MDC	0.005	0.068	0.072	0.943	-0.129	0.139	
Mining	MIN	0.014	0.086	0.163	0.871	-0.154	0.182	
Real estate	REE	0.175	0.056	3.113	0.002	0.065	0.286	***
Retail	RET	-0.077	0.064	-1.190	0.234	-0.203	0.050	
Services other	SER	-0.032	0.046	-0.698	0.485	-0.123	0.058	
Telecommunications	TEL	-0.073	0.062	-1.191	0.234	-0.194	0.047	
Transportation	TRP	0.042	0.069	0.617	0.537	-0.092	0.177	
EXS_Automotive	EXS_AUT	-0.307	0.143	-2.148	0.032	-0.587	-0.027	**
EXS_Biotechnology	EXS_BIO	0.094	0.116	0.816	0.415	-0.133	0.322	
EXS_Chemicals and materials	EXS_CHE	0.026	0.092	0.281	0.779	-0.154	0.205	
EXS_Computer software	EXS_COM	-0.072	0.060	-1.205	0.228	-0.189	0.045	
EXS_Construction	EXS_CON	0.020	0.071	0.285	0.776	-0.119	0.159	
EXS_Energy	EXS_ENE	0.037	0.064	0.577	0.564	-0.088	0.162	
EXS_Financial services	EXS_FIS	0.012	0.083	0.149	0.882	-0.150	0.175	
EXS_Industrial products	EXS_IND	-0.065	0.063	-1.025	0.305	-0.188	0.059	
EXS_Internet	EXS_INT	-0.116	0.077	-1.499	0.134	-0.267	0.036	
EXS_Leisure	EXS_LEI	0.109	0.085	1.285	0.199	-0.057	0.276	
EXS_Manufacturing other	EXS_MAN	0.039	0.087	0.453	0.651	-0.131	0.209	
EXS_Media	EXS_MED	0.159	0.101	1.564	0.118	-0.040	0.357	
EXS_Medical	EXS_MDC	-0.008	0.078	-0.101	0.920	-0.161	0.146	
EXS_Mining	EXS_MIN	-0.067	0.099	-0.672	0.502	-0.261	0.128	
EXS_Real estate	EXS_REE	-0.225	0.065	-3.470	0.001	-0.352	-0.098	***
EXS_Retail	EXS_RET	0.036	0.078	0.469	0.639	-0.116	0.188	
EXS_Services other	EXS_SER	0.054	0.052	1.055	0.292	-0.047	0.155	
EXS_Telecommunications	EXS_TEL	0.027	0.073	0.372	0.710	-0.117	0.171	
EXS_Transportation	EXS_TRP	0.004	0.080	0.054	0.957	-0.153	0.161	

Regression statistics	R-Squared	Adj.R-Sqr.	Std.Err.Reg.	Std. Dev.	N
	0.102	0.080	0.338	0.353	2080
Analysis of Variance					
Source	**df**	**Sum Sqrs.**	**F**	**P-value**	
Regression	50	26.414	4.614	0.000	
Residual	2029	232.287			
Total	2079	258.701			

6.2.3 Discussion: Interindustry differences

Given the evidence provided by the data, I reject hypothesis H2.1, and conclude that takeover premiums exhibit significant differences between industries. Not all industries, however, produce systematically different premiums. Instead, the effect appears to be limited to a handful of sectors, namely automotive, financial services, other manufacturing, and media. Among the above, the premiums are significantly higher within automotive and media sectors, while lower premiums are observed within acquisitions of financial services and other manufacturing companies.

Based on the results of the latter F-test, I also reject hypothesis H2.2. Accordingly, it is concluded that expected operational synergies' role as a determinant of the takeover premiums does differ between industries. Nonetheless, only two of the interaction effects between expected operational synergies and industry classes produce statistically significant coefficients. These variables are for automotive and real estate industries. Coefficients for the both significant interaction terms are negative.

As an interesting side note, 12 out of the 17 other sectors have positive, although insignificant, coefficients. A simple binomial (two-tailed) probability for such extreme distribution between positive and negative coefficient signs (assuming equal likelihood between the two) is less than 5%. One possible implication would be that the expected synergies drive the valuation weakly within some industries but not at all within other sectors, which further results in an insignificant coefficient estimate for expected operational synergies when all industries are pooled together. However, given the results of regression models (1) and (2), i.e. the estimated coefficients for the expected operational synergies are not only insignificant but in fact negative, the abovearticulated explanation seems unlikely to hold generally.

A possible implication of these results is that valuation processes associated with acquisitions follow different conventions between industries. The potential for operational synergy can be easier to assess within some industries relative to others. On that account, an example of cost-savings potential in merging two transportation networks as opposed to merging two high-

technology companies was given earlier in this paper. If the synergistic potential is easier to measure prior to the acquisition, it would be intuitively expected that larger portion of the expected synergy would be then incorporated in the premium. Nonetheless, the fact that none of the individual interaction variables between expected operational synergies and industries was estimated to be positively significant largely disallows drawing any further conclusions based on the employed data.

6.3 Momentum

6.3.1 Overall momentum effect

Regression statistics for model (4) with lagged residuals up to 20th order are presented in *Table 7: Results for test regression of Breusch-Godfrey test for 20:th order autocorrelation*. The test statistic, 35.978, is greater than the Chi-squared critical value (degrees of freedom: 24) with a significance level of 5%, 31.410. P-value for the test statistic is 0.015. It is therefore concluded that the estimated residual terms (jointly) in model (2) do exhibit significant autocorrelation.

Table 7: Results for test regression of Breusch-Godfrey test for 20:th order autocorrelation

Table presents the results for Breusch-Godfrey test regression, i.e. model (4), with the following specification:

$$\hat{\varepsilon}_t = \beta_0 + \beta_1 EXS_t + \sum_{j=2}^{12} \beta_j control\ variable_{t,j} + \sum_{k=13}^{31} \beta_k industry\ variable_{t,k} + \sum_{l=1}^{20} \rho_l \hat{\varepsilon}_{t-l} + u_t$$

The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP).

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		0.013	0.059	0.220	0.826	-0.103	0.129	
Expected synergies	EXS	-0.003	0.020	-0.147	0.883	-0.043	0.037	
Cross border Europe	CBE	-0.002	0.017	-0.118	0.906	-0.035	0.031	
Transatlantic	TRA	-0.010	0.023	-0.414	0.679	-0.055	0.036	
Log enterprise value	LEV	0.001	0.004	0.237	0.813	-0.007	0.009	
Financial investor	FIN	0.000	0.027	0.002	0.999	-0.053	0.053	
Hostile	HOS	-0.014	0.045	-0.311	0.756	-0.102	0.074	
Pre-rumoured	PRE	0.001	0.018	0.056	0.956	-0.034	0.036	
Equity payment	EQP	-0.010	0.028	-0.351	0.726	-0.065	0.045	
Mixed payment	MIP	-0.006	0.034	-0.176	0.860	-0.073	0.061	
Stock market index	SMI	0.000	0.000	-0.168	0.866	0.000	0.000	
Change in GDP	GDP	0.272	1.527	0.178	0.859	-2.720	3.264	
Euribor	EUR	0.000	0.005	-0.045	0.964	-0.010	0.009	
Automotive	AUT	0.015	0.054	0.278	0.781	-0.091	0.121	
Biotechnology	BIO	-0.008	0.056	-0.142	0.887	-0.118	0.102	
Chemicals and materials	CHE	0.000	0.043	-0.011	0.991	-0.085	0.084	
Computer software	COM	0.002	0.027	0.074	0.941	-0.051	0.055	
Construction	CON	-0.005	0.033	-0.152	0.880	-0.070	0.060	
Energy	ENE	-0.002	0.027	-0.074	0.941	-0.055	0.051	
Financial services	FIS	-0.006	0.025	-0.245	0.807	-0.054	0.042	
Industrial products	IND	-0.005	0.262	-0.019	0.985	-0.519	0.509	
Internet	INT	0.007	0.036	0.197	0.844	-0.063	0.077	
Leisure	LEI	0.001	0.040	0.028	0.978	-0.077	0.080	
Manufacturing other	MAN	-0.006	0.040	-0.150	0.881	-0.085	0.073	
Media	MED	0.005	0.037	0.135	0.893	-0.068	0.078	
Medical	MDC	0.005	0.034	0.148	0.882	-0.061	0.071	
Mining	MIN	0.007	0.045	0.157	0.876	-0.081	0.095	
Real estate	REE	0.002	0.029	0.068	0.946	-0.056	0.060	
Retail	RET	0.001	0.037	0.027	0.978	-0.071	0.073	
Services other	SER	-0.006	0.021	-0.283	0.777	-0.048	0.036	
Telecommunications	TEL	-0.002	0.035	-0.057	0.955	-0.071	0.067	
Transportation	TRP	-0.001	0.037	-0.027	0.978	-0.073	0.071	
E(-1)		0.001	0.023	0.044	0.965	-0.044	0.046	
E(-2)		0.022	0.023	0.966	0.334	-0.023	0.067	
E(-3)		-0.037	0.023	-1.621	0.105	-0.082	0.008	
E(-4)		-0.016	0.023	-0.703	0.482	-0.061	0.029	
E(-5)		0.021	0.023	0.918	0.358	-0.024	0.066	
E(-6)		0.001	0.023	0.044	0.965	-0.044	0.046	
E(-7)		-0.043	0.023	-1.893	0.058	-0.088	0.002	*
E(-8)		0.034	0.023	1.493	0.136	-0.011	0.079	
E(-9)		0.009	0.023	0.395	0.693	-0.036	0.054	
E(-10)		0.023	0.023	1.010	0.313	-0.022	0.068	
E(-11)		0.046	0.023	2.018	0.044	0.001	0.091	**
E(-12)		0.038	0.023	1.662	0.097	-0.007	0.083	*
E(-13)		-0.033	0.023	-1.448	0.148	-0.078	0.012	
E(-14)		-0.023	0.023	-0.999	0.318	-0.068	0.022	
E(-15)		-0.003	0.023	-0.131	0.896	-0.048	0.042	
E(-16)		-0.014	0.023	-0.613	0.540	-0.059	0.031	
E(-17)		-0.005	0.023	-0.219	0.827	-0.050	0.040	
E(-18)		0.014	0.023	0.613	0.540	-0.031	0.059	
E(-19)		-0.021	0.023	-0.926	0.354	-0.065	0.023	
E(-20)		0.042	0.023	1.855	0.064	-0.002	0.086	*

Regression statistics	**R-Squared**	**Adj.R-Sqr.**	**Std.Err.Reg.**	**N**
	0.017	-0.010	0.340	2082

Analysis of Variance

Source	**df**	**Sum Sqrs.**	**F**	**P-value**
Regression	51	4.015	0.639	0.985
Residual	2030	226.118		
Total	2081	230.133		

6.3.2 Momentum and expected operational synergies

The estimated autocorrelation coefficients, their estimated variances, and confidence intervals (two-tailed) are presented *Table 8: Autocorrelation and partial autocorrelation of monthly premium averages*. On a significance level of 5%, autocorrelation coefficients of order 1, 2, 4, and 5 are statistically significant. It is noteworthy that although the third order coefficient is insignificant, excluding it would likely give rise to type II error in the model specification as higher-than-third order terms are still significant. Thus, I include all lagged terms from the first up to the fifth order in the model.

Table 8: Autocorrelation and partial autocorrelation of monthly premium averages

Table presents the estimated autocorrelation and partial autocorrelation coefficients for monthly takeover premiums in the data sample. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.

#	Auto-correlation	Partial correlation	AC	PAC	Var(AC)	t-Stat.	P-value	Lower95%	Upper95%	Significance
1			0.228	0.228	0.009	2.357	0.018	-0.190	0.190	**
2			0.339	0.303	0.011	3.189	0.001	-0.208	0.208	***
3			0.155	0.037	0.012	1.432	0.152	-0.212	0.212	
4			0.256	0.144	0.013	2.261	0.024	-0.222	0.222	**
5			0.238	0.147	0.014	2.027	0.043	-0.230	0.230	**
6			0.104	-0.075	0.014	0.880	0.379	-0.232	0.232	
7			0.205	0.095	0.015	1.692	0.091	-0.237	0.237	*
8			0.051	-0.054	0.015	0.420	0.674	-0.238	0.238	
9			0.082	-0.064	0.015	0.673	0.501	-0.239	0.239	
10			0.072	0.045	0.015	0.589	0.556	-0.239	0.239	
11			0.033	-0.040	0.015	0.270	0.787	-0.240	0.240	
12			0.116	0.070	0.015	0.942	0.346	-0.241	0.241	

Based on the observed significance levels of the plotted autocorrelation coefficients, I estimate an ARMA model with the first five lagged terms included. The formal specification of the (pooled) ARMA(5,5) model is as follows:

$$TOP_t = \mu + \sum_{i=1}^{5} \phi_i TOP_{t-i} + \sum_{j=1}^{5} \theta_j \varepsilon_{t-j} + \varepsilon_t$$

$$= \mu + \phi_1 TOP_{t-1} + \phi_2 TOP_{t-2} + \cdots + \phi_5 TOP_{t-5} + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_5 \varepsilon_{t-5} + \varepsilon_t \quad (8)$$

The regression statistics for the estimated pooled model (8) are presented in *Table 9: Estimated ARMA(5,5) model for pooled monthly premium averages*. The (unrestricted) ARMA(5,5) model used in testing the parameter stability comes in two parts as follows:

a)

$$TOP_{a,t} = \mu_a + \sum_{i=1}^{5} \phi_{i,a} TOP_{a,t-i} + \sum_{j=1}^{5} \theta_{j,a} u_{t-j} + u_t \quad (9)$$

and

b)

$$TOP_{b,t} = \mu_b + \sum_{i=1}^{5} \phi_{i,b} TOP_{b,t-i} + \sum_{j=1}^{5} \theta_{j,b} v_{t-j} + v_t \quad (10)$$

, where

$a, b\ note\ for\ EXS = 1\ and\ EXS = 0, respectively$

In the estimated pooled model (8), all autoregressive coefficients from the first up to the fifth order lag are highly statistically significant while moving average terms are individually insignificant.

Table 9: Estimated ARMA(5,5) model for pooled monthly premium averages

Table presents regression statistics for estimated ARMA(5,5) model for monthly takeover premiums. $\phi(r)$ and $\theta(r)$ note for r:th order autoregressive and moving average terms, respectively. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.

Variable	Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant	0.262	0.026	10.129	0.000	0.211	0.313	***
φ(1)	0.998	0.224	4.448	0.000	0.558	1.438	***
φ(2)	0.861	0.109	7.909	0.000	0.648	1.074	***
φ(3)	-0.737	0.218	-3.372	0.001	-1.165	-0.308	***
φ(4)	-0.969	0.110	-8.820	0.000	-1.185	-0.754	***
φ(5)	0.759	0.172	4.400	0.000	0.421	1.097	***
θ(1)	-0.857	169.679	-0.005	0.996	-333.421	331.707	
θ(2)	-0.757	66.317	-0.011	0.991	-130.736	129.222	
θ(3)	0.395	200.550	0.002	0.998	-392.677	393.466	
θ(4)	1.128	328.109	0.003	0.997	-641.953	644.209	
θ(5)	-0.664	281.168	-0.002	0.998	-551.743	550.415	
σ^2	0.007	0.697	0.011	0.991	-1.360	1.375	

Regression statistics	**R-Squared**	**Adj.R-Sqr.**	**Std.Err.Reg.**	**N**
	0.280	0.205	0.091	118

Analysis of Variance

Source	**df**	**Sum Sqrs.**	**F**	**P-value**
Regression	11	0.343	3.739	0.000
Residual	106	0.885		
Total	117	1.228		

F-test results for the Chow's test for parameter stability between the two models, i.e. with and without expected operational synergies, are presented in *Table 10: Results for Chow's test for parameter stability between ARMA(5,5) models with and without expected operational synergies*. The F-statistic 0.427 (degrees of freedom: 12, 212) is statistically insignificant. It is therefore concluded that the coefficients for the autoregressive and moving average terms do not significantly differ between the models.

Table 10: Results for Chow's test for parameter stability between ARMA(5,5) models with and without expected operational synergies

Table presents results for Chow's test for parameter stability between two estimated ARMA(5,5) models for monthly premium averages, with and without expected operational synergies. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.

F-statistic	0.427	**P-value, F(12,212)**	0.952
Log likelihood ratio	13.627	**P-value, Chi-Square(12)**	0.325
Wald statistic	49.454	**P-value, Chi-Square(12)**	0.000

Results for the Z-tests for differences in individual estimated coefficients between the two models are presented in *Table 11: Results for Z-tests for differences in individual coefficients between ARMA(5,5) models with and without expected operational synergies*. None of the

autoregressive or moving average term coefficients significantly differ between the models on a 5% significance level. This is result is consistent with that of the Chow's test presented above.

Table 11: Results for Z-tests for differences in individual coefficients between ARMA(5,5) models with and without expected operational synergies

Table presents results for Z-tests for individual coefficients between two estimated ARMA(5,5) models for monthly premium averages, with and without expected operational synergies. $\phi(r)$ and $\theta(r)$ note for r:th order autoregressive and moving average terms, respectively. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.

Variable	Z	P-value	Lower95%	Upper95%	Significance
Constant	0.289	0.772	-1.960	1.960	
φ(1)	-0.387	0.699	-1.960	1.960	
φ(2)	0.065	0.948	-1.960	1.960	
φ(3)	1.361	0.174	-1.960	1.960	
φ(4)	1.294	0.196	-1.960	1.960	
φ(5)	-0.367	0.714	-1.960	1.960	
θ(1)	0.540	0.589	-1.960	1.960	
θ(2)	0.175	0.861	-1.960	1.960	
θ(3)	-1.334	0.182	-1.960	1.960	
θ(4)	-0.996	0.319	-1.960	1.960	
θ(5)	0.655	0.513	-1.960	1.960	
σ^2	-3.580	0.000	-1.960	1.960	***

6.3.3 Discussion: Momentum

Given the results of the Breusch-Godfrey test for 20th order autocorrelation, I fail to reject hypothesis H3.1, and conclude that the level of takeover premiums is significantly autocorrelated. This result is consistent with those of Simonyan (2014).

Significant differences between the two subgroups, with and without expected operational synergies, are not identified with the Chow's test for parameter stability. Similarly, Z-tests for differences between individual coefficients show no significant variation between the two groups. Therefore, I also fail to reject hypothesis H3.2, and conclude that the autocorrelative behavior of the takeover premiums is independent on the existence of expected operational synergies.

While Rosen (2006) proposes that the autocorrelation in takeover premiums is steered by an underlying momentum in the expected synergies, the results of this paper do not display such causality. On the contrary, I find that the existence of expected operational synergies does not

affect the time-series behavior of the takeover premiums. Therefore, other factors than the variation in expected synergies appear to be the root cause for momentum.

An alternative explanation, laid out by e.g. Gorton et al. (2005), is that mergers and acquisitions are driven by managerial motives. If a decision to bid for another company is triggered by managerial objectives, it is possible that acquisition quality is generally poorer during merger waves. However, while the volume of mergers and acquisitions is generally inflated during a strong market sentiment (see e.g. Goble and White, 1993; Shleifer and Vishny, 2003; Harford, 2005; and Rhodes-Kropf et al., 2005), market booms do not appear to engender higher premiums. In fact, Simonyan (2014) finds that premiums are significantly higher during times of investor pessimism, which does not support Gorton's et al. (2005) explanation for the momentum in takeover premiums.

Given the above discussion, I propose a theory that the autocorrelation in takeover premiums is caused by valuation benchmarking, rather than varying expected synergies or general market conditions. In other words, when acquiring companies, together with their associated advisors, are evaluating potential targets, the target value is, to some extent, drawn from valuation multiples of recent transactions. While Bikhchandani (1992) describes this process as collecting information about the profitability of the recent transactions, it is also possible that benchmarking is used merely to satisfy the selling company shareholders that the bid price is comparably attractive. Consequently, benchmarking in valuation processes establishes temporal market conventions for the "correct" level of premium. Idiosyncratic characteristics of the individual transactions, either positive or negative, then propel this conventional level upwards or downwards, as if by random. Thereby, in the long run, the series of takeover premiums paid at different points in time can be expressed as an autoregressive process with a random error term.

For the reader reference, monthly and quarterly averages of takeover premiums in the two subsamples as well as in the pooled model are plotted in *Figure 1: Time-series of monthly premium averages* and *Figure 2: Time-series of quarterly premium averages*, respectively. The figures highlight the observation that takeover premiums with and without expected operational synergies deviate mostly in terms of variance (as a consequence of different sample sizes) but otherwise do not visibly differ in their time-behavior.

Figure 1: Time-series of monthly premium averages

Figure presents monthly takeover premiums averages for all transactions (pooled) as well as two subgroups, with and without expected operational synergies, noted with EXS=1 and EXS=0, respectively. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.

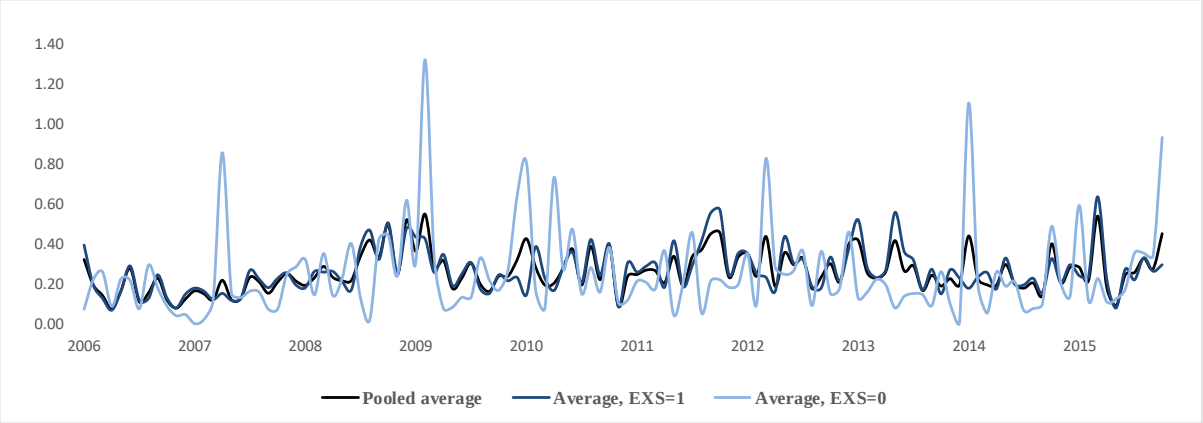
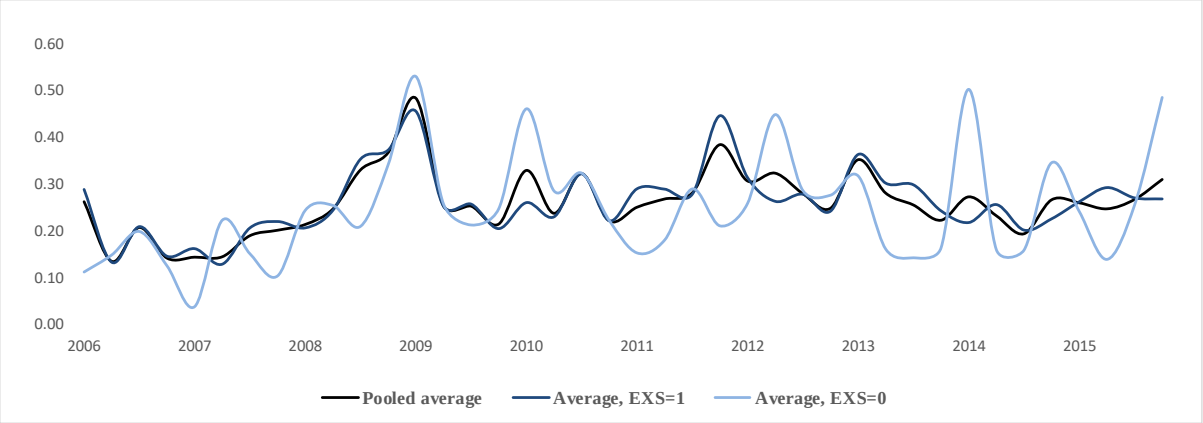


Figure 2: Time-series of quarterly premium averages

Figure presents quarterly takeover premiums averages for all transactions (pooled) as well as two subgroups, with and without expected operational synergies, noted with EXS=1 and EXS=0, respectively. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. Takeover premiums are defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement.



7 Robustness tests

This section tests the validity of classical linear regression model (CLRM) assumptions to sound the robustness of the results presented above. Specifically, I test for homoscedasticity,

linearity of the variable relationships and normality of the estimated residuals for the simple regression model (1) as well as model (2) including the industry binaries.

7.1 Homoscedasticity

To test for potential heteroscedasticity in the linear regression models, I run White's tests for regression models (1) and (2). Due to the high number of regressors and a possible collinearity issue, however, I exclude the cross-terms from the White's test regression. The formal specification of the estimated test regressions for models (1) and (2), respectively, are as follows:

$$\hat{\varepsilon}_{a,i}{}^2 = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \beta_{13} EXS_i{}^2 + \sum_{j=2}^{12} \beta_{j+12} control\ variable_{j,i}{}^2 + u_i \tag{11}$$

and

$$\hat{\varepsilon}_{b,i}{}^2 = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \beta_{32} EXS_i{}^2 + \sum_{j=2}^{12} \beta_{j+31} control\ variable_{j,i}{}^2 + \sum_{k=13}^{31} \beta_{k+31} industry\ variable_{k,i}{}^2 + v_i \tag{12}$$

, where

$\hat{\varepsilon}_a, \hat{\varepsilon}_b\ note\ for\ estimated\ residuals\ from\ models\ (1)\ and\ (2), respectively$

Under null hypothesis, the test statistics follow the χ^2 distribution (with degrees of freedom equals to the number of regressors excluding the constant term), and is calculated as follows.

$$TS = TR^2 \sim \chi^2(k)$$

, where

$T = number\ of\ observations$
$R^2 = R - squared\ of\ the\ estimated\ regression\ model\ (11)$ and (12)
$k = number\ of\ regressors\ in\ model\ (11)\ and\ (12), excluding\ constant$

Results for test regressions for model (1) and (2) are presented in *Table 12: Results for test regression of White's test for heteroscedasticity in model (1)* and *Table 13: Results for test regression of White's test for heteroscedasticity in model (2)*, respectively. According to the results, model specification (1) is homoscedastic with a test statistic of 17.551 (degrees of freedom 12) and a p-value of 0.130. Nonetheless, model (2) exhibits statistically significant heteroscedasticity with a test statistic of 70.250 (degrees of freedom 31) and a corresponding p-value of 0.000. Thus, including the set of industry binary variables makes the model prone to heteroscedasticity. This, however, merely affects the coefficients' estimated standard errors resulting in a heightened error type II probability. Estimated regression coefficients, nevertheless, are unbiased even in the presence of heteroscedasticity.

Table 12: Results for test regression of White's test for heteroscedasticity in model (1)

Table presents the results for test regression of White's test for heteroscedasticity for model (1) explaining corporate takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock

market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively.

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		0.284	0.066	4.308	0.000	0.155	0.413	***
Expected synergies^2	EXS	-0.048	0.042	-1.141	0.254	-0.131	0.034	
Cross border Europe^2	CBE	0.048	0.036	1.327	0.185	-0.023	0.118	
Transatlantic^2	TRA	0.038	0.048	0.779	0.436	-0.057	0.132	
Log enterprise value^2	LEV	0.000	0.001	-0.406	0.685	-0.002	0.001	
Financial investor^2	FIN	-0.082	0.057	-1.447	0.148	-0.193	0.029	
Hostile^2	HOS	-0.066	0.093	-0.712	0.476	-0.249	0.117	
Pre-rumoured^2	PRE	-0.068	0.038	-1.759	0.079	-0.143	0.008	*
Equity payment^2	EQP	-0.022	0.058	-0.384	0.701	-0.136	0.092	
Mixed payment^2	MIP	-0.061	0.070	-0.866	0.386	-0.199	0.077	
Stock market index^2	SMI	0.000	0.000	-2.374	0.018	0.000	0.000	**
Change in GDP^2	GDP	-1.108	187.432	-0.006	0.995	-368.469	366.253	
Euribor^2	EUR	0.001	0.002	0.548	0.584	-0.003	0.005	
Regression statistics		**R-Squared**	**Adj.R-Sqr.**	**Std.Err.Reg.**	**N**			
		0.008	0.003	0.735	2080			
Analysis of Variance								
Source		**df**	**Sum Sqrs.**	**F**	**P-value**	**TR^2**	**P-value**	
Regression		12	9.508	1.466	0.130	17.551	0.130	
Residual		2067	1117.340					
Total		2079	1126.848					

Table 13: Results for test regression of White's test for heteroscedasticity in model (2)

Table presents the results for test regression of White's test for heteroscedasticity for model (1) explaining corporate takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP).

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		0.271	0.069	3.932	0.000	0.136	0.407	***
Expected synergies[2]	EXS	-0.047	0.041	-1.155	0.248	-0.127	0.033	
Cross border Europe[2]	CBE	0.051	0.034	1.498	0.134	-0.016	0.119	
Transatlantic[2]	TRA	0.052	0.046	1.128	0.259	-0.039	0.143	
Log enterprise value[2]	LEV	0.000	0.001	-0.547	0.585	-0.002	0.001	
Financial investor[2]	FIN	-0.058	0.054	-1.065	0.287	-0.165	0.049	
Hostile[2]	HOS	-0.079	0.089	-0.894	0.372	-0.253	0.094	
Pre-rumoured[2]	PRE	-0.067	0.037	-1.842	0.065	-0.139	0.004	*
Equity payment[2]	EQP	-0.022	0.056	-0.393	0.694	-0.132	0.088	
Mixed payment[2]	MIP	-0.049	0.067	-0.731	0.465	-0.180	0.082	
Stock market index[2]	SMI	0.000	0.000	-2.384	0.017	0.000	0.000	**
Change in GDP[2]	GDP	-41.699	178.764	-0.233	0.816	-392.069	308.671	
Euribor[2]	EUR	0.001	0.002	0.654	0.513	-0.003	0.005	
Automotive[2]	AUT	0.406	0.106	3.834	0.000	0.198	0.614	***
Biotechnology[2]	BIO	-0.063	0.112	-0.560	0.575	-0.282	0.157	
Chemicals and materials[2]	CHE	-0.058	0.087	-0.663	0.507	-0.229	0.113	
Computer software[2]	COM	-0.009	0.054	-0.158	0.874	-0.115	0.098	
Construction[2]	CON	-0.098	0.066	-1.476	0.140	-0.227	0.032	
Energy[2]	ENE	-0.007	0.053	-0.130	0.897	-0.112	0.098	
Financial services[2]	FIS	-0.053	0.049	-1.079	0.281	-0.148	0.043	
Industrial products[2]	IND	-0.078	0.052	-1.496	0.135	-0.180	0.024	
Internet[2]	INT	-0.047	0.072	-0.655	0.513	-0.187	0.093	
Leisure[2]	LEI	0.041	0.078	0.528	0.597	-0.112	0.195	
Manufacturing other[2]	MAN	-0.067	0.079	-0.847	0.397	-0.223	0.088	
Media[2]	MED	0.256	0.074	3.467	0.001	0.111	0.400	***
Medical[2]	MDC	-0.024	0.067	-0.350	0.727	-0.155	0.108	
Mining[2]	MIN	-0.062	0.090	-0.693	0.488	-0.239	0.114	
Real estate[2]	REE	0.140	0.058	2.392	0.017	0.025	0.254	**
Retail[2]	RET	-0.061	0.073	-0.828	0.408	-0.205	0.083	
Services other[2]	SER	-0.007	0.042	-0.169	0.866	-0.090	0.076	
Telecommunications[2]	TEL	-0.052	0.071	-0.731	0.465	-0.190	0.087	
Transportation[2]	TRP	0.214	0.073	2.954	0.003	0.072	0.357	***

Regression statistics	R-Squared	Adj.R-Sqr.	Std.Err.Reg.	N
	0.034	0.019	0.689	2080

Analysis of Variance						
Source	**df**	**Sum Sqrs.**	**F**	**P-value**	**TR^2**	**P-value**
Regression	31	34.361	2.309	0.000	70.250	0.000
Residual	2048	983.028				
Total	2079	1017.389				

7.2 Linearity

Subsequently, I test the validity of the regression model specifications with regards to linearity of the relationship between the dependent and the independent variables. The test follows Ramsey's RESET procedure, whereby the estimated residuals are regressed on nonlinear combinations of the independent variables in addition to the original regressors. Joint significance of the coefficients for the nonlinear combination is tested with a standard F-test. I limit the test to second and third order nonlinear combinations. The formal (unrestricted) model specification of the auxiliary test regression for models (1) and (2) is as follows.

$$\hat{\varepsilon}_{a,i} = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \gamma_1 TOP_i{}^2 + \gamma_2 TOP_i{}^3 + u_i$$

(13)

and

$$\hat{\varepsilon}_{b,i} = \beta_0 + \beta_1 EXS_i + \sum_{j=2}^{12} \beta_j control\ variable_{j,i} + \sum_{k=13}^{31} \beta_k industry\ variable_{k,i} + \gamma_1 {TOP_i}^2 + \gamma_2 {TOP_i}^3 + v_i$$

(14)

, where

$\hat{\varepsilon}_a, \hat{\varepsilon}_b\ note\ for\ estimated\ residuals\ from\ models\ (1)\ and\ (2), respectively$

In the restricted regressions, coefficients for nonlinear combinations are set to zero, i.e.:

$$\gamma_1 = \gamma_2 = 0$$

Results for the Ramsey's RESET test for model (1) and (2) are presented in *Table 14: Results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables in model (1)* and *Table 15: Results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables in model (2),* respectively. With regards to model (1), the test statistic 1.668 (degrees of freedom 2, 2065) has a p-value of 0.189 implying that nonlinear combinations of the independent variables do not significantly explain the residuals. However, with model (2) the test statistic 7.612 (degrees of freedom 2, 2046) has a highly significant p-value of 0.001. Therefore, the relationship between the takeover premiums and the industry variables is not linear. As the industry indicators are binary variables, the nonlinearity appears to arise from the cross-terms between industries. Although a specification error in the model slightly reduces its prediction power, I ignore the issue for the fact that including the cross-terms in the model would make it excessively fussy, cotemporally decreasing the degrees of freedom. In addition, the adverse

effect of the observed nonlinearity is limited to the interpretation of individual industry variable coefficient estimates, while their joint impact is less affected.

Table 14: Results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables in model (1)

Table presents the results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables model (1) explaining corporate takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively.

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		-0.007	0.401	-0.018	0.985	-0.793	0.778	
Expected synergies	EXS	0.001	0.020	0.051	0.959	-0.037	0.039	
Cross border Europe	CBE	-0.011	0.048	-0.226	0.821	-0.106	0.084	
Transatlantic	TRA	-0.020	0.078	-0.256	0.798	-0.173	0.133	
Log enterprise value	LEV	0.003	0.015	0.227	0.820	-0.026	0.033	
Financial investor	FIN	0.006	0.043	0.148	0.882	-0.078	0.091	
Hostile	HOS	0.008	0.058	0.135	0.892	-0.106	0.122	
Pre-rumoured	PRE	0.015	0.096	0.159	0.873	-0.173	0.204	
Equity payment	EQP	-0.001	0.027	-0.021	0.983	-0.054	0.053	
Mixed payment	MIP	-0.003	0.033	-0.081	0.936	-0.067	0.062	
Stock market index	SMI	0.000	0.000	0.213	0.831	0.000	0.000	
Change in GDP	GDP	1.060	3.003	0.353	0.724	-4.826	6.946	
Euribor	EUR	-0.002	0.006	-0.248	0.804	-0.013	0.010	
Fitted^2		4.115	3.568	1.153	0.249	-2.879	11.108	
Fitted^3		-4.077	4.814	-0.847	0.397	-13.513	5.359	

Regression statistics	R-Squared	Adj.R-Sqr.	Std.Err.Reg.	N
	0.070	0.064	0.341	2080

Analysis of Variance	df	Sum Sqrs.	F	P-value
Regression	14	18.114	11.105	0.000
Residual	2065	240.587		
Total	2079	258.701		

Omitted: Fitted^2 and Fitted^3	Value	df	P-value
F-Statistic	1.668	(2, 2065)	0.189
Likelihood ratio	3.358	2	0.187

Table 15: Results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables in model (2)

Table presents the results for test regression of Ramsey's RESET test for prediction power of nonlinear combinations of explanatory variables model (2) explaining corporate takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases. The size of takeover premiums (TOP) is defined as the relative difference between the offer price and the target company's latest closing market value prior to the deal announcement. Dummy variable Expected operational synergies (EXS) note for transactions where the acquirer and the target operate in the same industry sector. With regards to the control variables, geographical reach of the transaction is classified with a set of geographic dummies, Cross border Europe (CBE), and Transatlantic (TRA). Variable Log enterprise value (LEV) notes for the natural logarithm of the implied target enterprise value. Bidder type is categorized with a dummy variable Financial investor (FIN). Method of payment is noted with a set of dummy variables Equity payment (EQP), and Mixed payment (MIP). Dummy variable Hostile (HOS) notes for bids that are considered as hostile. Dummy variable Pre-rumored (PRE) notes for pre-rumored bids. Business cycle related variables Stock market index (SMI), Change in GDP (GDP), and Euribor (EUR) note for monthly reported Eurozone stock market index, quarterly changes in reported Eurozone real GDP, and daily reported three-month euribor rate, respectively. Target company industry is noted with a set of industry classification dummies, Automotive (AUT), Biotechnology (BIO), Chemicals and materials (CHE), Computer software (COM), Construction (CON), Energy (ENE), Financial services (FIS), Industrial products (IND), Internet (INT), Leisure (LEI), Manufacturing other (MAN), Media (MED), Medical (MDC), Mining (MIN), Real estate (REE), Retail (RET), Services other (SER), Telecommunications (TEL), and Transportation (TRP).

Variable		Coefficient	Std.Err.	t-Stat.	P-value	Lower95%	Upper95%	Significance
Constant		0.532	0.260	2.043	0.041	0.022	1.042	**
Expected synergies	EXS	-0.001	0.020	-0.041	0.967	-0.040	0.039	
Cross border Europe	CBE	0.045	0.033	1.342	0.180	-0.021	0.110	
Transatlantic	TRA	0.070	0.052	1.350	0.177	-0.032	0.173	
Log enterprise value	LEV	-0.013	0.009	-1.427	0.154	-0.031	0.005	
Financial investor	FIN	-0.030	0.031	-0.977	0.329	-0.092	0.031	
Hostile	HOS	-0.042	0.052	-0.811	0.418	-0.145	0.060	
Pre-rumoured	PRE	-0.111	0.062	-1.771	0.077	-0.233	0.012	*
Equity payment	EQP	0.006	0.028	0.211	0.833	-0.048	0.060	
Mixed payment	MIP	-0.001	0.033	-0.020	0.984	-0.065	0.063	
Stock market index	SMI	0.000	0.000	-1.493	0.135	-0.001	0.000	
Change in GDP	GDP	-1.174	2.286	-0.514	0.608	-5.653	3.306	
Euribor	EUR	0.002	0.005	0.401	0.689	-0.008	0.013	
Automotive	AUT	0.069	0.102	0.675	0.500	-0.131	0.269	
Biotechnology	BIO	-0.014	0.055	-0.260	0.795	-0.122	0.094	
Chemicals and materials	CHE	-0.040	0.048	-0.836	0.403	-0.134	0.054	
Computer software	COM	0.006	0.027	0.218	0.828	-0.047	0.059	
Construction	CON	-0.048	0.042	-1.152	0.249	-0.130	0.034	
Energy	ENE	0.009	0.026	0.345	0.730	-0.043	0.061	
Financial services	FIS	-0.044	0.035	-1.262	0.207	-0.113	0.024	
Industrial products	IND	-0.039	0.036	-1.069	0.285	-0.109	0.032	
Internet	INT	0.018	0.037	0.487	0.626	-0.054	0.090	
Leisure	LEI	-0.048	0.047	-1.025	0.305	-0.141	0.044	
Manufacturing other	MAN	-0.084	0.059	-1.412	0.158	-0.200	0.032	
Media	MED	0.047	0.059	0.805	0.421	-0.068	0.163	
Medical	MDC	0.001	0.033	0.041	0.968	-0.063	0.066	
Mining	MIN	-0.033	0.047	-0.706	0.480	-0.126	0.059	
Real estate	REE	0.006	0.029	0.201	0.840	-0.051	0.062	
Retail	RET	-0.054	0.045	-1.212	0.226	-0.142	0.034	
Services other	SER	0.005	0.021	0.227	0.820	-0.037	0.047	
Telecommunications	TEL	-0.046	0.045	-1.020	0.308	-0.135	0.042	
Transportation	TRP	0.036	0.042	0.862	0.389	-0.046	0.119	
Fitted^2		-1.653	2.184	-0.757	0.449	-5.932	2.627	
Fitted^3		4.614	2.784	1.657	0.097	-0.842	10.069	*

Regression statistics	R-Squared	Adj.R-Sqr.	Std.Err.Reg.	N
	0.095	0.080	0.338	2080
Analysis of Variance				
Source	**df**	**Sum Sqrs.**	**F**	**P-value**
Regression	33	24.583	6.510	0.000
Residual	2046	234.118		
Total	2079	258.701		
Omitted: Fitted^2 and Fitted^3	**Value**	**df**	**P-value**	
F-Statistic	7.612	(2, 2046)	0.001	
Likelihood ratio	15.419	2	0.000	

7.3 Normality

Lastly, I analyze the distribution of the estimated residuals of models (1) and (2). As takeover premiums generally follow a heavily skewed distribution, together with the fact that even the most sophisticated regression models explaining takeover premiums tend to have relatively low R^2 ratios, it is expected that the normality of error terms in the regression models is compromised. This is tested with a Jarque-Bera test, which effectively compares the skewness and kurtosis of the estimated residual distribution as opposed to those of the normal distribution. The test statistic follows χ^2 distribution (with degrees of freedom of 2), and is calculated as follows.

$$W = T\left(\frac{\left(\frac{E(\hat{\varepsilon}^3)}{(\sigma^2)^{\frac{3}{2}}}\right)^2}{6} + \frac{\left(\frac{E(\hat{\varepsilon}^4)}{(\sigma^2)^2} - 3\right)^2}{24}\right) \sim \chi^2(2)$$

, where

$T = number\ of\ observations$

$\frac{E(\hat{\varepsilon}^3)}{(\sigma^2)^{\frac{3}{2}}} = skewness\ of\ estimated\ residuals$

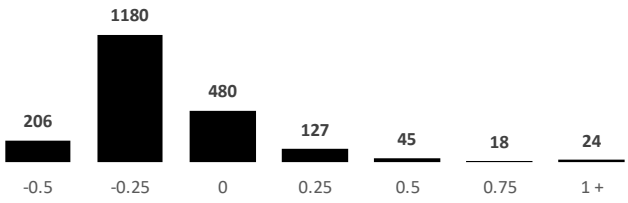
$\frac{E(\hat{\varepsilon}^4)}{(\sigma^2)^2} = kurtosis\ of\ estimated\ residuals$

Residual distributions for estimated models (1) and (2) are presented in *Table 16: Results for Jarque-Bera test for residual distribution in model (1)* and *Table 17: Results for Jarque-Bera test for residual distribution in model (2)*, respectively. The corresponding test statistics are 135,571 and 119,958, both highly significant with p-values of 0.000. Therefore, residuals are not normally distributed, as was expected. The Jarque-Bera test statistic, however, is particularly sensitive for a few extreme outliers in the sample. With regards to the takeover premiums in the data sample used in this study, observations of higher than 100% premiums are relatively infrequent but much more so than what the normality assumptions would imply. Also, as premiums tend to show a large variation but are exclusively positive, the distribution is strongly skewed to the right. However, a slight nonnormality of the residuals does not generally affect the results considerably. In addition, most observations in the data sample are located relatively close to the mode of the residual distribution, with an exception of a few considerable outliers. Therefore, the interpretation of the estimated regression coefficients is not notably compromised. Consequently, further model specification adjustments are not introduced due to the nonnormality of estimated residuals.

Table 16: Results for Jarque-Bera test for residual distribution in model (1)

Table presents the results for Jarque-Bera test for residual distribution normality for model (1) explaining takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases.

Residual distribution

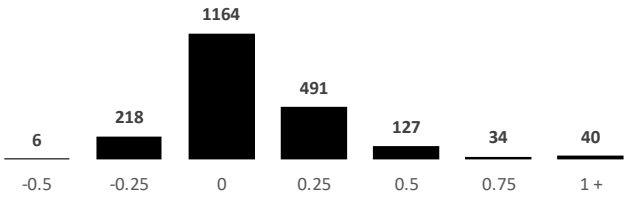


Sample statistics	
N	2080
Mean	0.000
Median	-0.076
Maximum	4.031
Minimum	0.441
Std.Dev.	0.340
Skewness	4.811
Kurtosis	41.363
Jarque-Bera test stat.	135572
P-value	0.000

Table 17: Results for Jarque-Bera test for residual distribution in model (2)

Table presents the results for Jarque-Bera test for residual distribution normality for model (2) explaining takeover premiums. The data sample consists of 2,082 European public corporate acquisitions announced between Jan 2006 and Sep 2015, and recorded by Oct 2015 in Mergermarket database. The data is extracted from Mergermarket, S&P Capital IQ and Quandl databases.

Residual distribution



Sample statistics	
N	2080
Mean	0.000
Median	-0.067
Maximum	3.862
Minimum	-0.541
Std.Dev.	0.337
Skewness	4.616
Kurtosis	39.040
Jarque-Bera test stat.	119958
P-value	0.000

8 Summary and conclusions

This paper studies the relationship between expected operational synergies and acquisition premiums paid in corporate takeovers. The analysis is threefold. Firstly, the relationship between premiums and expected operational synergies is studied to find out to what extent the two are interconnected. This is done by a simple OLS regression.

In the second part, the analysis is extended to identify any interindustry differences in the abovementioned effect. The purpose of this is to sound whether the expected operational synergies' role as a determinant of takeover premiums vary between different industry settings. This is done by regressing takeover premiums on a set of binary industry indicators (main effects) as well as interaction effects between industries and expected operational synergies in a subsequent analysis.

Thirdly, the takeover premiums' time-behavior is studied to identify whether variations in expected operational synergies can explain the momentum in the premiums. On that account, an autoregressive moving average (ARMA) model is estimated for monthly premium averages. The estimated model parameters are subsequently compared between two groups, with and without expected operational synergies.

The results can be summarized as follows.

1. Takeover premiums are found to be generally independent on expected operational synergies when all industries are considered jointly. A positive premium is observed for geographically diversifying acquisitions relative to those where the acquirer and the target represent the same domicile. Notable determinants with negative effects on the premiums include a large target company size and information leakages prior to the deal announcement. Moreover, the premiums, measured in relative terms, are found to be higher during economic downturns as opposed to times of high investor optimism.
2. Takeover premiums display significant differences between industries. The highest level of premiums is observed in automotive and media industries, whereas the lowest premiums are paid in financial services and manufacturing (other) industries. While expected operational synergies do not have a significant positive effect on the premiums in any individual industry, the synergies' role as a determinant of premiums is found to significantly deviate among different industries. Due to large variation in the estimated coefficients for expected operational synergies for individual industries, however, a close-to-zero coefficient is estimated when all industries are pooled together.
3. Takeover premiums are found to exhibit momentum. Significant autocorrelation coefficients are observed for up to five lagged monthly periods. The autoregressive behavior is not found to significantly deviate between the two subsamples, with and without expected operational synergies. Therefore, the momentum effect is not found to be driven by varying levels of expected synergy.

Failing to observe any notable causality between takeover premiums and expected operational synergies challenges the way mergers and acquisitions are generally perceived. In most cases, the rationale for a takeover is that the two companies are worth more together than the sum of their separate parts. Hence, there is synergistic value to be created via merging. However, if empirical evidence suggests that operational synergies have in fact little to do with the paid acquisition premiums, hardly any rational grounds exist for acquisitions valued at considerable

premiums. Therefore, a vigilant investor of a potential acquirer should be on the alert for such acquisition announcements. A possible exception for the above are potential financial synergies such as tax benefits that are undisputed and well documentable prior to the deal execution.

These results are consistent with those of Slusky and Caves (1991) and Gondhalekar et al. (2004) who likewise find no significant dependency between operational synergies and takeover premiums. However, somewhat contradictory results have been proposed by Lambrecht (2004) and Gupta and Gerchak (2002), although not specifically in the operational domain of synergies. I expect that the differences in the outcomes of these studies stems from the variation in methodological approaches employed by the researchers. More specifically, the actual concept under investigation in the line of research has been varying from operational cost-side synergies to revenue synergies and even financial arbitrage. Therefore, a recommended starting point for future studies would be to accentuate what type of synergies are of primary interest, and subsequently develop an appropriate measure, as opposed to covering all sources of possible synergistic value with a singular proxy variable, as has largely been the general convention in the literature to date.

Concerning interindustry differences, it is possible that valuation processes follow different customs between industries with regards to how expected synergies are incorporate in the bid price. In this paper, I have proposed a theory that companies operating in certain industries can estimate the operational synergies more accurately, and therefore adjust their bids more on the basis of the synergy expectation. Consequently, it would be expected that expected synergies would affect the premiums more when the acquirer and the target company operate with traditional business models where the cost-savings potential via a merger is relatively easy to measure ex ante. While significant differences in the effect were confirmed by the data with a joint test, the results failed to identify any specific industries where expected operational synergies would be extensively incorporated in the bid prices. Interindustry differences in the connection between premiums and expected operational synergies are largely an undocumented area in the extant research, and benchmark results are therefore not available.

The observed momentum in takeover premiums is consistent with the results of Simonyan (2014). With regards to the cyclical nature of premiums, while Rosen (2006) speculatively discusses a possible explanation that changing levels of expected synergy common to all transactions drive the momentum effect in premiums, the results of this study do not support

this view. Instead, I conclude that the time-development of takeover premiums is not dependent on the expected operational synergies.

Given the above discussion, I present that differences in takeover premiums can be partly explained by valuation benchmarking. I.e., acquiring companies use recently paid premium levels as reference points to determine a comparably acceptable bid price, even in the lack of clear rational support for this given valuation level. Individual deal characteristics gradually propel this temporary market convention as if by random rather than as a consequence of changing levels of synergy. Thereby, takeover premiums paid in different points in time follow an autoregressive process where the error terms are near random, as opposed to rational explanations.

References

Alexandridis, G., Fuller, K., Terhaar, L., Travlos, N., 2013. Deal size, acquisition premia and shareholder gains. *Journal of Corporate Finance*, 20(1), pp.1–13.

Amihud, Y., Lev, B., Travlos, N., 1990. Corporate Control and the Choice of Investment Financing: The Case of Corporate Acquisitions. *The Journal of Finance*, 45(2), pp.603–615.

Andrade, G., Mitchell, M., Stafford, E., 2001. New Evidence and Perspectives on Mergers. Journal of Economic Perspectives, 15(2), pp.103–120.

Ayers, B., Lefanowicz, G., Robinson, J., 2003. Shareholder Taxes in Acquisition Premiums: The Effect of Capital Gains Taxation. *The Journal of Finance*, 58(6), pp.2783–2801.

Baker, M., Pan, X. & Wurgler, J., 2009. The Psychology of Pricing in Mergers and Acquisitions, Working Paper, Harvard University and NYU.

Bargeron, L., Schlingemann, F., Stulz, R., Zutter, C., 2008. Why do private acquirers pay so little compared to public acquirers? *Journal of Financial Economics*, 89(3), pp.375–390.

Bebchuck, L., 1994. Efficient and Inefficient Sales of Corporate Control. *Quarterly Journal of Economics*, 109, pp.957–993.

Belot, F., 2010. Target Shareholder agreements, takeover premium, and acquisition likelihood, Working paper, University of Paris.

Berkovitch, E. & Narayanan, M., 1993. Motives for takeovers: An empirical investigation. *Journal of Financial and Quantitative Analysis*, 28(9), pp.347–362.

Bikhchandani, S., Hirshleifer, D. & Welch, I., 1992. A Theory of Fads, Fashion, Custom, and Cultural Change as Informational Cascades. *Journal of Political Economy*, 100(5), pp.992–1026.

Box, G., Jenkins, G., 1976. Time series analysis forecasting and control. Revised ed., Holden-Day, San Francisco, CA.

Bradley, M., Desai, A. & Kim, E.H., 1988. Synergistic Gains from Corporate Acquisitions and Their Division Between The Shareholders Of Target and Acquiring Firms. *Journal of Financial Economics*, 21, pp.3–40.

Brown, R. & Sarma, N., 2007. CEO overconfidence, CEO dominance and corporate acquisitions. *Journal of Economics and Business*, 59(5), pp.358–379.

Burkart, M.C. & Panunzi, F., 2004. Mandatory Bids, Squeeze-out, Sell-out and the Dynamics of the Tender Offer Process, *Modern company and takeover law in Europe*, 2004, p.737-765.

Burkart, M., Gromb, D. & Panunzi, F., 2000. Agency conflicts in public and negotiated transfers of corporate control. *Journal of Finance*, 55(2), pp.647–677.

Cai, Y. & Sevilir, M., 2012. Board connections and M& A transactions. *Journal of Financial Economics*, 103(2), pp.327–349.

Caves, R., 1975. Diversification, Foreign Investment, and Scale in North American Manufacturing Industries. Economic Council of Canada, Ottawa.

Chang, S., Mais, E., 2000. Managerial Motives and Merger Financing. *The Financial Review*, 35(4), pp.139–152.

Cheng, P., Li, J., Tong, W., 2008. Information asymmetry in the takeover market, Working paper, EFMA.

Christofferson, S., McNish, R., Sias, D., 2004. Where mergers go wrong. *McKinsey on Finance*, 10, Winter.

Clogg, C., Petkova, E. & Haritou, A., 2016. Statistical Methods for Comparing Regression Coefficients Between Models. *American Journal of Sociology*, 100(5), pp.1261–1293.

Damodaran, A., 2005. The Value of synergy. Stern School of Business.

De La Bruslerie, H., 2013. Crossing takeover premiums and mix of payment: Empirical test of contractual setting in M&A transactions. *Journal of Banking & Finance*, 37, pp.2106–2123.

De Long, B., Shleifer, A., Summers, L., Waldmann, R., 1990. Noise Trader Risk in Financial Markets. *Journal of Political Economy*, 98(4), pp.703–738.

Dos Santos, M., Errunza, V., Miller, D., 2008. Does corporate international diversification destroy value? Evidence from cross-border mergers and acquisitions. *Journal of Banking & Finance*, 32(12), pp.2716–2724.

Doukas, J., Petmezas, D., 2007. Acquisitions, Overconfident Managers and Self-attribution Bias. *European Financial Management*, 13(3), pp.531–577.

Eccles, R., Lanes, K., Wilson, T., 1999. Are you paying too much for that acquisition?. *Harvard Business Review*, 77(4), pp.136–146.

Eckbo, B., Giammarino, R., Heinkel, R., 1990. Asymmetric Information and the Medium of Exchange in Takeovers: Theory and Tests. *Review of Financial Studies*, 3(4), pp.651–675.

Ficery, K., Herd, T. & Pursche, B., 2007. Where has all the synergy gone? The M&A puzzle. *Journal of Business Strategy*, 28(5), pp.29–35.

Fuller, K., Netter, J. & Stegemoller, M., 2002. What do returns to acquiring firms tell us? Evidence from firms that make many acquisitions. *Journal of Finance*, 57(4), pp.1763–1793.

Golbe, D., White, L., 1993. Catch a Wave: The Time Series Behavior of Mergers. *The Review of Economics and Statistics*, 75(3), pp.493–499.

Gondhalekar, V., Sant, R. & Ferris, S., 2004. The price of corporate acquisition: determinants of cash takeover premia. *Applied Economics Letters*, 11(12), pp.735–739.

Gorton, G., Kahl, M., Rosen, R., 2005. Eat or be eaten: A theory of mergers and merger waves, Working paper 11364, NBER.

Gupta, D. & Gerchak, Y., 2002. Quantifying Operational Synergies in a Merger/Acquisition. *Management Science*, 48(4), pp.517–533.

Hansen, R., 1987. A Theory for the Choice of Exchange Medium in Mergers and Acquisitions. *The Journal of Business*, 60(1), pp.75–95.

Harford, J., 2005. What drives merger waves? *Journal of Financial Economics*, 77(3), pp.529–560.

Haw, I.-M., Pastena, V., Lilien, S., 1987. The Association between Market-Based Merger Premiums and Firms' Financial Position Prior to Merger. *Journal of Accounting, Auditing & Finance*, 2(1), pp.24–42.

Hayn, C., 1989. Tax attributes as determinants of shareholder gains in corporate acquisitions. *Journal of Financial Economics*, 23(1), pp.121–153.

Hayward, M., Hambrick, D., 1997. Explaining the Premiums Paid for Large Acquisitions: Evidence of CEO Hubris. *Administrative Science Quarterly*, 42(1), pp.103–127.

Holl, P. & Kyriazis, D., 1997. Wealth creation and bid resistance in UK takeover bids. *Strategic Management Journal*, 18(6), pp.483–498.

Kengelbach, J. et al., 2013. Divide and Conquer: How Successful M&A Deals Split the Synergies, Technische Universität München & The Boston Consulting Group

Krishnan, H., Hitt, M., Park, D., 2007. Acquisition premiums, subsequent workforce reductions and post-acquisition performance. *Journal of Management Studies*, 44(5), pp.709–732.

Laamanen, T., 2007. On the role of acquisition premium in acquisition research. *Strategic Management Journal*, 28, pp.1359–1369.

Lambrecht, B., 2004. The timing and terms of mergers motivated by economies of scale. *Journal of Financial Economics*, 72(1), pp.41–62.

Lang, L., Stulz, R., Walkling, R., 1989. Managerial performance, Tobin's Q, and the gains from successful tender offers. *Journal Financial Economies*, 24(1), pp.137–154.

Lang, L., Stulz, R., Walkling, R., 1991. A test of the free cash flow hypothesis: The case of bidder returns. *Journal Financial Economies*, 29(2), pp.315–335.

Lee, W., Jiang, C. & Indro, D., 2002. Stock market volatility, excess returns, and the role of investor sentinent. *Journal of Banking & Finance*, 26(12), pp.2277–2299.

Lemelin, A., 1982. Relatedness in the patterns of interindustry diversification. *Review of Economics & Statistics*, 64(4), pp.646–658.

Madura, J. & Ngo, T., 2008. Clustered synergies in the takeover market. *Journal of Financial Research*, 31(4), pp.333–356.

Malmendier, U. & Tate, G., 2005. CEO Overconfidence and Corporate Investment. *The Journal of Finance*, 60(6), pp.2661–2700.

Malmandier, U. & Tate, G., 2008. Who Makes Acquisitions? CEO Overconfidence and the Market's Reaction. *Journal of Financial Economics*, 89(0), pp.20–43.

Mitchell, M., Mulherin, J., 1996. The impact of industry shocks on takeover and restructuring activity. *Journal of Financial Economics*, 41, pp.193–229.

Moeller, S., Schlingemann, F., Stulz, R.M., 2005. Wealth destruction on a Massive Scale: A study of Acquiring Firm Returns in the Merger Wave of the Late 1990s. *Journal of Finance*, 60(2), pp.757–782.

Mulherin, J., Boone, A., 2000. Comparing acquisitions and divestitures. *Journal of Corporate Finance*, 6(2), pp.117–139.

Officer, M., 2003. Termination fees in mergers and acquisitions. *Journal of Financial Economics*, 69, pp.431–467.

Rhodes-Kropf, M., Robinson, D.T. & Viswanathan, S., 2005. Valuation waves and merger activity: The empirical evidence. *Journal of Financial Economics*, 77(3), pp.561–603.

Rosen, R., 2006. Merger Momentum and Investor Sentiment: The Stock Market Reaction to Merger Announcements. *The Journal of Business*, 79(2), pp.987–1017.

Rumelt, R., 1974. Strategy, Structure, and Economic Performance. Division of Research, Graduate School of Business Administration, Harvard University.

Shleifer, A. & Vishny, R.W., 2003. Stock market driven acquisitions. *Journal of Financial Economics*, 70(3), pp.295–311.

Simonyan, K., 2014. What determines takeover premia: An empirical analysis. *Journal of Economics and Business*, 75, pp.93–125.

Slusky, A. & Caves, R, 1991. Synergy, Agency, and the Determinants of Premia Paid in Mergers. *The Journal of Industrial Economics*, 39(3), p.277.

Song, M. & Walkling, R., 1993. The Impact of Managerial Ownership on Acquisition Attempts and Target Shareholder Wealth. *Journal of Financial and Quantitative Analysis*, 28(4), pp.439–457.

Stulz, R., 1988. Managerial control of voting rights: Financing policies and the market for corporate control. *Journal Financial economies*, 29, pp.25–54.

Stulz, R., Walkling, R. & Song, M., 1990. The Distribution of Target Ownership and the Division of Gains in Successful Takeovers. *The Journal of Finance*, 45(3), pp.817–833.

Trautwein, F., 1990. Merger motives and merger prescriptions. *Strategic Management Journal*, 11(4), pp.283–295.

Travlos, N., 1987. Corporate Takeover Bids, Methods of Payment, and Bidding Firms' Stock Returns. *The Journal of Finance*, 42(4), pp.943–963.

Vanne, J., 2015. Public Takeover Premiums During Recessions: The Empirical Evidence. Bachelor's Thesis, Aalto University

Volpin, P., 2002. Governance with poor investor protection: evidence from top executive turnover in Italy. *Journal of Financial Economics*, 64, pp.61–90.